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THE ANTRUM OPERATION: DESCRIBING A METHOD AFFORDING PERMANENT, ADEQUATE DRAINAGE WHERE CURE OF THE EMPYEMA IS ESSENTIAL.*†‡

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Perhaps the earliest surgical technique employed for the treatment of disease of the maxillary sinus was puncture through a tooth socket. For the effect of gravity this approach is ideal. The small size of the opening maintained and the consequent contamination of the sinus from the mouth interfered with recovery and led to the abandonment of the method.

Another old but seldom employed method was the operative opening of the antrum through the canine fossa and the maintenance of a fistula. This method did not include the establishment of an opening into the nose and passed into oblivion.

With increased rhinological experience the antrum was attacked from the nasal wall. Openings were made of varying degrees of usefulness. A proportion of satisfactory results are obtained today by this approach.

Desire for improvement led to the combined attack. The antrum is entered through the canine fossa. The mucosa may

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or may not be removed. A counter opening is made into the nose. The incision is sutured or allowed to close. This is the so-called radical antrum operation. It has been considered the last word in the surgical management of antrum disease.

It is, nevertheless, not above criticism. In the hands of good surgeons it gives fairly satisfactory results. When such results are carefully analyzed, however, not more than perhaps 80 per cent of the cases will show an antrum free from discharge when cytologically examined. The advantage of drainage from any inferior meatal opening has been questioned because of the direction of ciliary action, which is toward the natural ostium.

Even if the technique is competent to care for the antrum infection alone, it fails in the face of discharge draining downward into the antrum from the upper sinuses. Disease of the upper sinuses so frequently complicates the picture that the ethmoids are often operated upon at the same time, usually transantrally and intranasally. As this technique cannot command the supraorbital ethmoid cells, the problem of drainage into the antrum is not solved in that way.

It is frequently very difficult to determine the exact condition of an antrum after the Caldwell-Luc operation. The cavity may be so nearly obliterated that it is hard to get a return for cytological study. If discharge is present it may be difficult to discover its source. Failure, then, by this operation to exclude the antrum as a source of discharge still leaves one in doubt as to whether operation on the upper sinuses is necessary.

Another and stronger criticism of the Caldwell-Luc operation concerns the removal of the mucosal lining. Practically all are agreed as to the advisability of doing this when it is infected. Grave consequences, of which I find no mention, sometimes, unfortunately, follow this practice. They consist in the formation of walled off abscesses which arise for the following reasons: It is theoretically impossible to remove all of the mucosa because of extensions about vessels or elsewhere into the bone. Even though the lining has apparently been removed in a single piece, these microscopic islands may be left to form the basis of a cyst or, if infected, an abscess.

Then, too, the antrum cavity may fill with blood at or after the operation. This may occur, on its withdrawal, even

when packing is used. It is impossible to remove all the blood clot by washing or otherwise through the nasal opening and, consequently, the clot organizes. The reformed epithelium covers the clot and thus the postoperative cavity of the antrum is often much reduced in size. The organized clot forms a thick, fibrous submucosa. This feature is not objectionable when the lining has covered the bone smoothly. Unfortunately, the heavy, newly-formed lining may, on the one hand, have covered a microscopic island of epithelium and thus locked in a cyst, or, on the other hand, it may have formed in irregular fashion, enclosing and walling off infected areas which later give trouble.

Fig. 1. This specimen shows the result of a radical antrum operation. There is an opening into the nose as shown by the indicator. A history obtained later told that the original lining had been removed. The diseased lining shown here confirms the observations recorded on page 496.

Even when there is no blood to speak of, the granulation process does not always advance smoothly and equally. Irritated by some crusted discharge or otherwise, excrescences arise from the granulating surface, meet others of the same type and inclose and wall off infected areas. One with large experience will recall the fibrous bands and unfavorable formation of the lining, not infrequently seen at reoperation (see Figs. 1 and 2).

I have come to believe that removal of the lining of any sinus cavity entails a very serious responsibility. That responsibility can be fairly met only by obliterating or furnishing adequate drainage to the cavity operated upon. If

our endeavor fails to completely and properly and permanently drain the cavity, then we had better choose the lesser evil and leave the mucosa intact.

The following case finally climaxed my accumulated experience and led me to try to find a way to manage unusual cases: A woman with badly diseased antra consulted me. They had both been operated upon according to the Caldwell-Luc method. I reoperated upon the antra and found on both sides dense, fibrous lining that had walled off very imperfectly draining pus pockets. The antra failed to heal properly and,

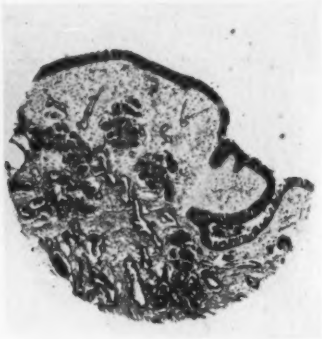

Fig. 2. Microscopic section of diseased regenerated antral lining shown in Fig. 1. The reformed columnar ciliated epithelium are demonstrated.

eventually, after a long interval, again developed the same type of purulent discharge. The fact that the other sinuses were free from disease and the antra the logical source of serious disease led me to operate again on both antra. Again I found fibrous pockets of pus.

In order to control the healing of the process, I now left a large opening in the canine fossae on both sides. Through these openings I saw the features I have mentioned that interfere with healing. The blood clot formed. It could be removed only with the greatest difficulty. Later, when the bone was clean, granulating excrescences developed that had to be controlled. This could easily be done through the large canine opening of one side. That side recovered completely, maintaining a persistent opening and a thin, smooth, pink mucosa and no discharge.

The opposite canine opening closed in spite of all I could do and the antrum did not heal. Eventually, it became as bad as ever. Then, after developing methods for keeping the opening patulous, I operated again, establishing a large permanent opening and obtained an antrum free from discharge and lined by a thin, pink mucosa.

In the past three years my associates and I have operated upon 14 cases by this method. We have used it for reoperation and for other cases that presented unusual difficulties. We are pleased with it and find it hard to advise any less certain procedure. Its objectionable feature is, of course, the persistence of the curative opening. All cases are absolutely

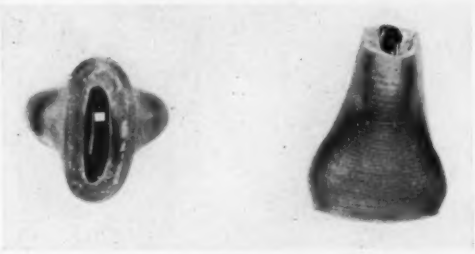

Fig. 3. Rubber tube with ends flattened at right angles to each other for establishing permanent opening into antrum through canine fossa.

free from discharge where a large opening has been maintained.

The method may be epitomized as follows: Under local anesthesia the usual Caldwell-Luc technique is carried out. The antrum is packed with vaselined gauze which is teased out gently in the first few postoperative days. The patient is taught at once to take a mouthful of warm saline solution and by closing the lips, force it out the nose. It may be necessary to attack any obstinate clot and remove it under direct vision.

In a short time — a few days — the opening begins to contract. Then the special rubber tube is placed in position. This tube is about 3 cm. long (see Fig. 3). The ends are flattened at right angles to each other. The outer end lies outside the bony opening and under the lip. The inner end lies in the antrum. It is thus self retaining, can be removed,

cleansed and replaced. It is hollow for drainage and soft for its pressure on the soft parts. When the opening is completely epithelialized the tube may be left out. This may take several weeks and the experience is unpleasant (see Fig. 4).

Maintaining a large opening is very difficult. A small opening is worse than useless because it allows the entrance of food and does not provide for its exit. A large opening is almost a part of the mouth, is covered by the lip and can be tolerated by the patient. None of them like it. They prefer it to the disease, however. That there is no complaint in the literature at the difficulty in preserving a large opening convinces me of the originality of the method. The concern I have felt over the ultimate closure of the sublabial incision

Fig. 4. Shows edentulous patient with permanent opening into antrum through the canine fossa.

has been changed to a feeling of annoyance at the real difficulty of maintaining a large, satisfactory opening when wanted.

We have employed a flap from the nasal mucosa to line the opening, but it did not serve. We are now turning the antral mucosa from the anterior wall down over the lower part of the incision. It helps to epithelialize, but our main dependence remains upon the rubber tube.

It has been illuminating to see pale, boggy inferior turbinates, distinctly of the allergic type, regain their form and tone after excluding antrum discharge completely in this way.

When discharge runs down into the antrum from the upper sinuses, its source can be plainly seen and it is not retained

in the antrum. The large openings are a nuisance. They may be covered by various protheses. Food enters, but is not retained and causes no disturbance to the cavity. The patients learn to manage fairly well and are content, particularly when serious disease has been benefited. The openings may be closed perhaps when conditions warrant.

I feel that the method here described has a place in the treatment of the diseased antrum. That place can only be measured by experience. It seems to apply particularly to correction of unsuccessful operative results.

Since the presentation of this article an unpublished report of treatment of the antrum along similar lines, by Dr. G. C. Otrich, has been brought to my attention. His method differs in that he does not consider a large permanent opening essential. He reports excellent results following the establishment of a fistula of from $\frac{1}{4}$ to $\frac{3}{8}$ in. in diameter.

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COMPLICATIONS OF ACUTE SINUSITIS WITH SPECIAL REFERENCE TO BACTEREMIAS.*†

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In a recent report by Goldman and Shwartzman[1] it was shown that in 42 per cent of 168 cases of streptococcus hemolyticus bacteremia, the portal of entry was an otolaryngological infection. In no instance, however, was a bacteremia associated with an uncomplicated case of acute sinusitis. It is well known that the occurrence of a positive blood culture in a case of acute mastoiditis predicates the existence of a complication. In view of the similarity in structure in mucous membrane, bony wall and vessels of the mastoid bone and paranasal sinuses, one might conjecture that the occurrence of a positive blood culture in a case of acute sinusitis might also predicate the existence of a complication. A study was therefore undertaken to determine the import and the relationship between bacteremias and acute paranasal sinus infections and their complications. An analysis was also made of the important features of these complications.

For the eight year period between 1928 and 1936, 300 cases of acute sinusitis were admitted to the Mt. Sinai Hospital. Of these, 210 manifested no evidence of any complication. These 210 cases were divided into two groups, those whose temperatures were below 103° F. and those above this level. This temperature was taken as a dividing line because blood cultures were usually made when the fever rose above 103°. Of the 129 cases with a temperature below 103°, a blood culture was taken in only four instances; but of the 81 cases with a temperature above 103°, a blood culture was taken in 30, *i e.*, in 37 per cent of the cases. In neither group was bacterial growth obtained on blood culture.

The remaining 90 cases of acute sinusitis presented in each instance some complication originating from that infection. These complications were grouped as follows: *I.* Orbital Cellulitis. *II.* Orbital Abscess. *III.* Osteomyelitis of Skull. *IV.* Acute

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Purulent Meningitis. *V.* Brain Abscess. *VI.* Cavernous Sinus Thrombosis. *VII.* Miscellaneous Infections.

In this paper only the salient facts concerning the complications will be considered. Data as to the operations and the bacteriology of the different sinus infections will not be discussed. It might be mentioned, however, that either intranasal or external operations were performed on 67 of the 90 patients with complications. Also the bacteria which were usually isolated from the infected sinuses were the various types of streptococci, staphylococci, and pneumococci. The streptococcus hemolyticus and the staphylococcus aureus were the organisms most frequently obtained.

I.— ORBITAL CELLULITIS.

There were 27 cases of orbital cellulitis with one death, an infant, age 1 year, who had developed bronchopneumonia. Eighteen of these patients were under 10 years of age and 21 were males.

The original source of infection in 13 instances was an ethmoiditis, in seven a frontal sinusitis of which six showed perforations, in six a pansinusitis, and in one a perforated maxillary sinusitis.

Blood cultures were taken in six cases and all proved sterile.

II.— ORBITAL ABSCESS.

There were 13 patients whose sinusitis was complicated by an orbital abscess. There was also one death in this group — an elderly woman, age 62 years, with a pansinusitis who had developed a streptococcus hemolyticus bacteremia. Nine of the 13 patients were less than 10 years of age.

The source of the infection for these orbital abscesses was an ethmoiditis in 10 cases, of which six had perforations; frontal sinusitis in two; and a pansinusitis in one.

In this group the blood of four patients was cultured and from two of these the streptococcus hemolyticus was obtained.

III.— OSTEOMYELITIS OF SKULL.

In 20 cases osteomyelitis of the skull resulted from an acute sinusitis. The ages of these patients were fairly equally distributed over six decades.

Of the 20 cases, 11 recovered and nine died — five from acute purulent meningitis, two from subdural abscesses, one from a brain abscess, and another from septicemia. The sinuses involved in these fatal cases were the frontal in five instances and the sphenoid in four.

The frontal sinus was the source of infection in 12 of the 20 cases. The sphenoid was involved in four cases and each one resulted in a fatal issue.

Of the 12 patients whose blood was cultured in this group, bacterial growth was obtained in five cases. The streptococcus hemolyticus grew out in three instances, the staphylococcus aureus in one, and the pneumococcus Type XXI in another instance.

IV.— ACUTE PURULENT MENINGITIS.

Acute purulent meningitis was the direct complicating condition in 14 cases. The ages were widely distributed and all the patients died.

Review of the bacteriology of the cerebrospinal fluid showed the invading organism to be the streptococcus hemolyticus in nine cases, pneumococcus Type III in two cases, and pneumococcus Type XXIX in one case.

In this group, blood cultures were taken in eight cases and organisms were cultivated in four instances. In two cases the streptococcus hemolyticus was isolated and in the two others the pneumococcus Type III.

V.— BRAIN ABSCESS.

There were five patients who developed brain abscess secondary to a sinusitis. The frontal lobe was involved in four cases and a subdural abscess of the frontal lobe comprised the fifth case. One patient with a frontal lobe abscess recovered; the rest died.

Only one patient's blood was cultured in this group and this was reported sterile.

VI.— CAVERNOUS SINUS THROMBOSIS.

Six patients with acute sinusitis developed purulent thrombosis of the cavernous sinus. Five of the patients were under

12 years of age and the sixth patient was 32 years of age. All died.

The source of infection in three cases was an ethmoiditis, and in the three other cases a combined maxillary sinusitis and ethmoiditis, a frontal sinusitis, and pansinusitis respectively.

The blood of three patients was cultured and bacterial growth was obtained from each. The streptococcus hemolyticus was isolated from two cases and the staphylococcus aureus from the third.

These six cases constitute about three-eighths of all the cases of cavernous sinus thrombosis admitted to the hospital during the past 18 years. In view of this high percentage, a virulent paranasal sinus infection, particularly in children, must be regarded as a comparatively frequent focus of infection for cavernous sinus thrombosis.

VII.— MISCELLANEOUS INFECTIONS.

There were five patients in this group. Three of these comprised a case of sympathetic meningitis following an acute ethmoiditis, a case of meningomyeloencephalitis following a maxillary sinusitis and ethmoiditis, and a case of temporal edema following an ethmoiditis and frontal sinusitis. These cases recovered, the latter two after operation.

The two remaining cases are deserving of special mention. The first was a boy, age 7 years, who was admitted to the hospital with an acute pansinusitis and high fever. A blood culture taken on admission revealed a pneumococcus Type I. The report of this blood culture led to the recognition of a coexisting lobar pneumonia.

The other patient was a male, age 36 years, who was also admitted to the hospital with an acute pansinusitis and high fever. Again a blood culture was taken and this time Gram positive cocci in chains were isolated from the fluid media. This organism (probably streptococcus hemolyticus) did not grow out of subcultures for final identification. The following day the erythema of erysipelas appeared on the face. It has been observed by others and by us in the past that a bacteremia may exist very early in the case of primary erysipelas, even before the erythematous lesion becomes manifest.

TABLE I.

Group	Cases	Died	Sources of Infection	Blood Cultures Taken	Positive Blood Cultures	Bacteria
I. Orbital Cellulitis	27	1	Ethmoid ..... 13 Frontal ..... 7 6 Perf. Pansinus .... 6 Maxillary 1	6	0	
II. Orbital Abscess	13	1	Ethmoid ..... 10 6 Perf. Frontal ..... 2 1 Perf. Pansinus 1	4	2	Strep. Hemo.
III. Osteomyelitis of Skull	20	9	Frontal ..... 12 Sphenoid .... 4 Maxillary .... 3 Pansinus 1	12	5	Strep. Hemo., 3 Staph. Aur., 1 Pneumo. XXI, 1
IV. Acute Purulent Meningitis	14	14	Pansinus .... 5 Sphenoeth .... 3 Sphenoid .... 2 Frontal ..... 2 Ethmoid ..... 1 Sphenoeth-ectomy 1	8	4	Strep. Hemo., 2 Pneumo. III, 2
V. Brain Abscess Front. Lobe, 4 Fr. Subdur., 1	5	4	Frontal ..... 4 Sphenoid 1	1	0	
VI. Cavernous Sinus Thrombosis	6	6	Ethmoid ..... 3 Maxillary & Ethmoid 1 Frontal ..... 1 Pansinus 1	3	3	Strep. Hemo., 2 Staph. Aur., 1
VII. Miscellaneous	5	0				
Symp. Mengitis.			Ethmoid	0	--	
Men.-Myelo-Encephal.			Maxillary & Ethmoid	1	0	
Temporal Edema			Ethmoid & Frontal	0	--	
Lobar Pn. & Acute Sin.				1	1	Pneumo. I
Erysip. Face & Acute Sin.				1	1	Gram Pos. Cocci in Chains

DISCUSSION.

Of the 90 patients with complications of acute paranasal sinusitis by direct extension, 35 died — a mortality rate of 39 per cent. This high death rate was essentially due to the following serious complications: Acute purulent meningitis, cavernous sinus thrombosis, brain abscess and osteomyelitis of the skull. Orbital cellulitis and orbital abscesses were

complications rarely associated with fatality. It is worthy of mention that many of the acute sinus infections which led to the serious group of complications were acute exacerbations of chronic infections.

Blood culture studies were made on 37 of the 90 patients. Of these 37 patients bacterial growth was obtained from the blood of 16, or in 44 per cent of the cases in which blood cultures were taken. In evaluating this figure one must bear in mind that only in a few instances was more than one blood culture taken on a single patient. It seems likely that many more positive blood cultures would have been obtained had the blood cultures been performed routinely. This was demonstrated in five cases whose blood was not cultured during life and who showed pathologic evidence of general infection on necropsy examination.

Of the 16 positive cultures, the streptococcus hemolyticus was obtained in 11; the pneumococcus Type III in two; and the pneumococcus Type I, the pneumococcus Type XXI, and the staphylococcus aureus in one each.

Thus in 210 cases of uncomplicated acute sinusitis, 34 blood cultures were made and all were sterile despite the fact that 30 of these 34 were taken in patients with a temperature above 103° F. Of the 90 cases of acute sinusitis associated with a complication, the blood of 37 was cultured, of which 16 were reported as positive (see Table II). In one of these cases the bacteremia may have preceded the complication. These findings would appear to indicate that, except for possibly an occasional case, the occurrence of a positive blood culture in acute sinusitis points to the coexistence of a complication or some associated systemic infection.

TABLE II.

ANALYSIS OF BLOOD CULTURES.

Total Cases	300	
Uncomplicated Cases	210	
Blood Cultures Taken	34	
(Temperature Over 103° F.	30)	
Positive	0	All Sterile
Complicated Cases	90	
Blood Cultures Taken	37	
Positive	16	44%

These observations are of particular significance in the group of cases of purulent meningitis associated with bacte-

remia. The meningitis in this type of case should not be interpreted as the localization of a systemic bacteremia. Operative findings and necropsy examinations have demonstrated that in patients with a coexisting meningitis and bacteremia, the meningitis is usually due to direct extension of the sinus or otitic infection. The bacteremia is very likely the result of the meningitis.

This study suggests that routine blood cultures in acute sinus infections may prove to be of value in helping to determine the presence of a complication. Further investigation of a number of large series of such cases may show that a positive blood culture in acute paranasal sinusitis bears the same import as in acute mastoiditis and acute otitis media.

In conclusion, a possible explanation based on anatomical vascular structure may be offered for the failure of acute paranasal sinusitis to develop bacteremia unless followed by complications. The veins that drain the mucous membrane of the paranasal sinuses and penetrate their bony cells may be so small that they become thrombosed and sealed off before organisms can enter the general circulation. When a focus is set up in the skull, meninges or orbit by contiguous extension from a sinusitis, however, invasion of the blood stream may then occur from an infection of the larger veins which drain these sites. These veins because of their larger size do not thrombose so easily and are able to feed the general circulation repeatedly with showers of bacterial emboli.

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SPHENOIDITIS WITH MENINGITIC SYMPTOMS.*†

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Benign or uncomplicated sphenoidal sinusitis is a well known entity to most rhinologists. This condition is characterized by pain, usually lateral occipital or temporal, and by associated symptoms such as postnasal discharge, tinnitus, cough, fever, and distant myalgias. There is, however, another type of sphenoid sinusitis in which the clinical course is different in that intracranial involvement is predominant and the sphenoid sinusitis is likely to be overlooked as the basic lesion. We are concerned with this latter group of cases tonight.

In 1929‡ we reported at this Section nine fatal cases of sphenoid sinusitis with intracranial complications. We are now reporting 10 additional cases with meningitic symptoms, six of which terminated fatally. One of the four recovered cases probably represented a fortunate patient whose intracranial extension became localized and permitted satisfactory surgical therapy. The three remaining cases that recovered after appropriate therapy represent either early stages of the fatal cases or they may have been of a more benign nature from the very onset, due to some unknown factor such as anatomic structure, virulence of the organism, or resistance of the host.

Symptoms and Signs: The cardinal, almost pathognomonic, symptom was pain in the occiput, often radiating to the temporal region and down the spine. This type of pain, occurring early in the course of the illness before the onset of meningeal irritation, is very significant and is probably referable to disease in the sphenoid sinus. Occipital pain, often excruciating and unyielding, was present in eight of the 10 cases. Furthermore, the pain, as in other bone lesions such as mastoiditis, is more marked at night. In two fatal instances,

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†From the Laryngological Service of the Mt. Sinai Hospital, New York.

‡Dr. Rudolph Kramer: Intracranial Complications Following Sphenoid Infections. The Laryngoscope, Vol. XXXIX, Sept., 1929.

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the symptoms of an overwhelming sepsis predominated the picture and headache was not an outstanding symptom.

A low-grade elevation of temperature, except in instances of frank bacterial meningitis with marked hyperpyrexia, was a constant feature of the disease. At least one attack of vomiting was present in most cases from the incipiency of the illness.

The more disturbing symptoms, *viz.*, photophobia, vertigo, persistent vomiting, meningeal cry, chills, and finally stupor are directly attributable to the meningeal irritation and usually succeeded the onset of occipital headache by a shorter or longer interval. On admission, all patients complained of some or all of the above mentioned meningitic symptoms and demonstrated in addition definite signs of meningeal irritation. The initial physical examination revealed a spastic or rigid neck in all 10 cases; a positive Kernig in five cases; and a positive Brudzinski in three instances. Three of the fatal cases were admitted in stupor and two of these showed evidences of an overwhelming sepsis with positive blood cultures. Except in the latter three instances, the meningitic symptoms were no more prominent in the fatal cases than in those which ultimately recovered.

Intranasal Examination: The intranasal examination may or may not show evidences of suppuration in the sphenoid sinus. The finding of purulent secretion in the superior meatus is suggestive of sphenoiditis; however, the absence of pus in the region of the sphenoid is no assurance that there may not be an accumulation of pus within the sphenoid giving rise to meningitic symptoms. Irrigation of the sphenoid, after thorough cleansing of the nasal cavity, is the most dependable test for the determination of the infection. The X-ray may be of value when positive, but negative films should not deter one from further investigation by irrigation of the sphenoid. When the clinical history is suggestive of sphenoiditis with meningitic symptoms, the sphenoid sinus should be promptly irrigated. It may be necessary in rare cases to refract the middle turbinate in order to reach the ostium of the sinus, but this should not deter one from proceeding with the irrigation. If surgery is not immediately necessary, Roentgenographic films, after the injection of lipiodol, may afford important information concerning the anatomy and

pathology of the sphenoid. In practically all cases, the affected sphenoid was well pneumatized and often extended into the posterior part of the basisphenoid, completely outlining the floor of the sella turcica.

Diagnosis: The realization that meningitic symptoms are not infrequently due to sphenoiditis will direct attention more often to the sphenoid as the site of the origin of the infection. The 10 cases now being reported were observed at the Mt. Sinai Hospital during the past two years.

The history of occipital pain preceding the onset of meningitic symptoms should focus attention on an infection in the sphenoid sinus. A careful intranasal examination, especially by posterior rhinoscopy, may further support this suspicion by the finding of pus in the region of the sphenoid recess. Roentgenographic examination if positive, and the presence of secretion on irrigation of the sphenoid confirm the diagnosis of sphenoiditis.

Having established the existence of an infection in the sphenoid, this diagnosis should be assumed to be correct, unless there be unequivocal evidences of another etiology for the meningitic symptoms. Lumbar puncture is important in that the cytology and study of the smear may definitely demonstrate the presence of a more likely cause for the meningitic symptoms, *viz.*, meningococcus meningitis, tuberculous meningitis, or subarachnoid hemorrhage. A careful neurologic examination should be performed to exclude acute encephalitis or anterior poliomyelitis. Other possible foci such as fracture of the skull, suppuration in another paranasal sinus, or metastases to the meninges during a pyemia must be considered. If any of the latter conditions can be definitely proved, the sphenoiditis must be assumed to be a coexistent infection and not directly responsible for the meningitic symptoms.

The presence of an associated infection in the middle ear or mastoid renders the decision as to the more likely focus very difficult but does not militate against the sphenoid sinusitis as the basic focus. It may be necessary to explore the mastoid to exclude it, yet the sphenoid must not be overlooked while the mastoid receives energetic therapy. We have seen a mastoid exenterated and then the petrous pyramid explored fruitlessly in search of a suppurative focus which proved to be in the sphenoid at necropsy. In our 19 cases we have had

six cases of fatal meningitis due to sphenoiditis which had an associated benign middle ear suppuration.

In two of our recovered cases amelioration of the meningitic symptoms was promptly obtained after diagnostic lavage of the sphenoid sinus. This can be interpreted as a confirmatory therapeutic test when positive, but failure to obtain relief by lavage has no significance whatsoever.

Treatment: In a patient with meningitic symptoms and sphenoiditis, if no other specific etiology is discernible, a sphenoethmoidectomy should be performed, for which proce-

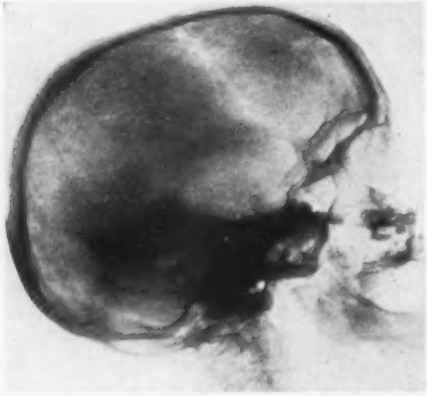

Fig. 1. Roentgenograph showing large sphenoid sinus and an abscess cavity filled with lipiodal extending posteriorly into basisphenoid outlining the floor of the sella turcica.

dure we use the intranasal route. Even if relief is obtained after diagnostic lavage, operation should not be delayed in the hope that irrigations may suffice. The exenteration of the ethmoidal labyrinth and sphenoid under local anesthesia is an innocuous and safe procedure permitting adequate drainage of the affected sinuses. Unnecessary risks to the patient's life are not assumed by the proper execution of this operation which in these instances may be life saving. Few patients may be regarded as too ill to undergo sphenoidectomy.

After removal of the anterior wall of the sphenoid to the level of its floor, the sinus should be thoroughly investigated for its anatomic extent and pathologic changes in the mucosa

and bone. Particular attention should be given to recesses extending into the body of the basisphenoid. These should be in turn generously opened.

The treatment of the mucosal lining deserves special consideration. In our four cases which recovered, the mucosa was left intact. Should meningitic signs and symptoms of osteomyelitis of the basisphenoid persist after the initial operation, it seems advisable to strip the mucosa of the sinus and further investigate the cancellous bone with curettes and special chisels. This procedure was carried out at a second operation in one of our fatal cases. A slit-like opening in the medial aspect of the left sphenoid was exposed after chiselling into the medial lower part of the posterior wall of the sphenoid. The posterior wall of both sphenoids and the intersinus septum was removed, exposing a cavity which contained thick pus. The bony floor of the sella turcica occupied the upper anterior portion of the cavity. This was clearly demonstrated by X-ray examination with lipiodol (Plate I). It is possible and occasionally necessary to remove diseased bone far enough posteriorly to expose dura and explore the subdural space for evidences of epidural abscess.

Prognosis: After analyzing these cases with meningitic symptoms, we tried to subdivide them into separate groups according to severity of symptoms and signs and the ultimate outcome. We hoped to be able to relegate each new case, when first seen, into its proper category and thereby estimate the probable pathology and prognosis. This has been found impossible on any criterion. Even after prolonged observation it is not always possible to place any individual case into any group which will aid in prognosis.

The study of the cerebrospinal fluid does offer some information which may be of prognostic significance indirectly. All cases with bacterial meningitis succumbed to their infection, regardless of the therapy employed. In our four cases which recovered the cerebrospinal fluid cell count was not higher than 270 cells in any instance. All cases with 500 cells or over had a positive spinal fluid culture and ended fatally. One may thus conclude that an original high cell count in these cases is of grave significance. On the other hand, a low or normal cerebrospinal fluid cell count should not be interpreted as a

good prognostic sign, since in three of our six fatal cases, the initial cell count was zero, 15, and 16 cells respectively.

Early operation would seem to enhance the likelihood of recovery (two cases), but fulminating cases are encountered which resist all therapeutic efforts and, conversely, protracted cases occasionally do well after the institution of proper treatment. Before relegating any case with meningitic symptoms to this group, one must first exclude the other more common causes of meningitis and then establish the presence of sphenoiditis. We are all acquainted with the coexistence of sphenoid sinusitis with various forms of meningitis, especially meningococcus meningitis, and recognize this as a possible portal of entry; however, we are here concerned only with those instances where the sphenoid is the sole factor in the production of meningitic symptoms.

The diagnosis of meningococcus meningitis may present insurmountable difficulties for the first 24 to 48 hours, since the most careful studies of smears may yield negative results and the culture may not show any growth for 48 hours. In view of these facts, a case may be operated upon erroneously on the assumption that the infection in the sphenoid is the sole exciting factor in the production of the meningitic symptoms. This indeed happened in one case at the hospital. The diagnosis of meningococcus meningitis was not established until 48 hours after hospitalization; nevertheless, the patient made a prompt uneventful recovery, in spite of an unnecessary sphenoethmoid operation. It should be mentioned that all cases with cloudy spinal fluid receive antimeningococcus serum intrathecally and are treated as epidemic meningitis until proved otherwise. The treatment should not be interrupted because the sphenoid is tentatively regarded as the site of origin of the infection.

Case Reports: We are citing two case histories which are illustrative of this condition and of the difficulties in prognosis.

Case 1: F. S., male, age 18 years, was admitted to the Laryngological Service with a history of fever and headache for five days preceding admission which followed an acute upper respiratory infection. Two days prior to admission he developed severe pain in the occiput which persisted and was

accompanied by dizziness, nausea, and vomiting. On admission, the patient was apathetic and listless, temperature was 102°, pulse 88. There was definite spasticity of the neck, but no Kernig or Brudzinski. The pharynx was congested and the entire nasal mucosa was uniformly inflamed. There was a thick gob of pus in the nasopharynx with a collection of purulent secretion in the fossa of Rosenmuller. A lumbar puncture showed a clear fluid with 270 cells of which 42 per cent were polymorphonuclear leukocytes and 58 per cent lymphocytes. Smear showed no bacteria. Neurological examination revealed no evidence of disease of the central nervous system. A diagnosis of sphenoiditis with meningitic symptoms was made and a bilateral intranasal sphenoethmoidectomy was performed. The mucosa of the floor of the left sphenoid was red and thickened. Granulations were present on the floor and lateral wall of the sphenoid. Mucoid secretion covered the walls of the sphenoid. Attached to the lateral wall of the left sphenoid was a pedunculated cyst 1½ cm. in diameter; this was not inflamed. Culture of the sphenoidal secretion showed staphylococcus aureus in pure culture. The day following operation, rigidity of the neck was diminished and the temperature became normal. The patient made an uneventful recovery. Blood count on admission was 13,000 white blood cells with 78 per cent polymorphonuclear leukocytes.

Case 2: M. R., a diabetic female, age 54 years, was admitted to the Medical Service of Dr. George Baehr because of unyielding occipital headache for four days, associated with fever and vomiting. Examination revealed a thin female, apparently in pain, holding head in flexion. Temperature, 102°; pulse 80. The neck was rigid but there was no Kernig or Brudzinski. Neurological examination revealed absence of superficial reflexes, otherwise negative. Blood pressure 160/88. Lumbar puncture yielded a clear, transparent fluid under normal pressure. Cerebrospinal fluid count showed 120 cells with 24 per cent polymorphonuclears and 76 per cent lymphocytes. The left sphenoid was irrigated and pus obtained. Culture revealed staphylococcus aureus. The diabetes was readily controlled. A bilateral sphenoethmoidectomy was performed, at which time a small amount of glairy secretion was located in the pterygoid extension of the left sphenoid. This yielded staphylococcus aureus on culture. The meningeal symptoms persisted and the pain in the occiput became excruciating. A second opera-

tion was performed after five days. After chiselling into the mesial portion of the lower posterior wall of the left sphenoid, a large abscess cavity was uncovered. The mucosa was markedly inflamed. The cavity extended behind the sella turcica. Pathologic examination of removed bone showed the presence of an osteomyelitis. This patient succumbed 10 days later. The original blood count showed 14,000 white blood corpuscles with 89 per cent polymorphonuclear leukocytes.

Both cases had almost exactly corresponding histories, even as to duration and the same symptoms and signs, except that the patient that recovered had a higher spinal cell count on admission. But, even in restrospect, from all the data available when the clinical diagnosis was made, we cannot determine the prognosis. We therefore urge early opening of the sphenoid sinuses. If relief is not obtained by this procedure, exploration of the basisphenoid is indicated.

121 East 60th Street.

REPARATIVE PROCESSES IN THE LABYRINTH SECONDARY TO MENINGOCOCCUS MENINGITIS. REPORT OF CASE.*†

DR. JOSEPH G. DRUSS, New York.

Labyrinthitis is not an infrequent complication of meningococcus meningitis. The incidence varies with each epidemic. In some epidemics the infection shows predilection for the VIIIth nerve; in others this nerve is more or less spared. The routes of extension of the infection to the labyrinth are not definitely known. It is assumed, however, that the extension takes place along pre-existing channels, such as the internal auditory meatus and the aqueductus cochleae or by way of the blood stream. Pathologic changes in the labyrinth occur at a relatively early stage of the disease, during which the membranous parts, including the sensory end organs, are particularly involved. It is chiefly the late or healed stages of the labyrinthitis, however, that will be considered in this paper.

REPORT OF CASE.

W. Y., a boy, age 10 years, following an attack of meningococcus meningitis five years previously which lasted six weeks, developed bilateral deafness. He was treated at an institution for the deaf where he remained up to the time of admission to the Mt. Sinai Hospital. He was admitted on Nov. 9, 1934, with signs of an acute fulminating bronchopneumonia due to influenza, from which he succumbed at the end of 10 hours.

He was a full term child of normal spontaneous labor and development. He talked at the age of one year. Because of the severity of the illness, tuning fork and vestibular tests were not made by the otologic service; however, routine physi-

*Read before New York Academy of Medicine, Section on Otolaryngology, Feb. 19, 1936.

†From the otologic service of Dr. Friesner and the Department of Laboratories of the Mt. Sinai Hospital.

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cal examination by the house staff revealed that he was apparently a deaf mute. He did not hear nor respond to questions.

An inquiry was made at the institution where the child resided as to the function of the cochlear and vestibular nerves. I was surprised to learn that on the last examination made shortly after the attack of meningitis (3A Western Electric Audiometer used) there was a loss of only 20 per cent of hearing in each ear. Speech was apparently unimpaired. Vestibular tests were not performed. No subsequent functional tests were made.

Postmortem examination revealed a hemorrhagic influenzal bronchopneumonia. Examination of the brain, paying particular attention to the nerves, revealed no abnormalities.

Histologic examination of the temporal bone: The tympanum and mastoid are essentially negative except for slight engorgement of the vessels in the mucosa lining these spaces. The tympanic membrane is normal.

The labyrinthine spaces, including the cochlear and vestibular portions, are almost completely occupied by newly formed bone. This is particularly true of the semicircular canals. The endosteum and the other membranous parts of the labyrinth are entirely destroyed, so that the lymphatic spaces can no longer be discerned. The few areas in the labyrinth not replaced by new bone are occupied by dense scar tissue. The largest of these areas is present in the vestibule, smaller ones in the cochlea. The newly formed bone within the semicircular canals resembles very closely that of the adjacent bony capsule. They are so intimately bound together that differentiation is extremely difficult. Only at one site, that of the ampullated ends of the external and superior semicircular canals, can the bony capsule be partially outlined. Within the cochlea and vestibule, however, the newly formed bone is more or less sharply demarcated from the capsule. The lamina ossea spiralis and the footplate of the stapes are necrosed and replaced by new bone. The secondary tympanic membrane is also partially ossified. The aqueductus cochleae is occluded and the ductus endolymphaticus is traversed by fibrous bands. All nerve endings within the labyrinth are entirely destroyed. Marked atrophic changes are present in the vestibular and cochlear divisions of the VIIIth nerve.

The cells in the spiral ganglion and in Scarpa's ganglion show similar alterations.

Comment: This case demonstrates, histologically, the picture of the end-result in the process of healing of labyrinthitis secondary to meningococcus meningitis. Almost the entire labyrinthine space is replaced by new bone, so that the membranous parts and the nerve elements can no longer be discerned. The structure of the newly formed bone within the semicircular canals resembles very closely that of the adjacent bony capsule. A sharp line of demarcation between the two can no longer be made. In the cochlea and vestibule, however, differentiation is less difficult.

The route of extension of the infection to the labyrinth cannot be determined, ossification having taken place about the modiolus and within the aqueductus cochleae. Extension along one or both of these is most plausible, although invasion by way of the blood stream cannot be definitely ruled out.

It is difficult to account for the audiometric reading — a loss of only 20 per cent in hearing in each ear — in the presence of a total destruction of all end organs. It is possible that certain uninvolved islands within the cochlea continued to function after the attack of meningitis but were subsequently destroyed, either by the continued infection in the labyrinth or by scarring and new bone formation in the process of repair.

General Discussion: The reparative processes are essentially the same here as in labyrinthitis due to other causes. They naturally depend upon the severity of the inflammation. This report concerns itself chiefly with the terminal stage in the process of healing of the more severe inflammations. Here, new bone formation is a characteristic feature.

The new bone is of two types, metaplastic and the osteoplastic. The former originates from the scar or connective tissue, the latter from the adjacent bone capsule. These two types of bone not infrequently develop concomitantly in one lesion. Osteoplastic bone is formed only in the event that the endosteal lining is destroyed and the bony capsule necrosed.

Following meningococcus meningitis the entire labyrinthine space may be completely replaced by new bone. The most prevalent sites of complete bony occlusion, in order of their

frequency, are the semicircular canals, the cochlea and the vestibule. It will be observed that the frequency is inversely proportionate to the width of the lumen within these structures. Naturally, the new bone can bridge across the semicircular canal with greater facility than the vestibule. Occasionally the new bone extends through the oval and round windows into the tympanum, partially obliterating this cavity, or it may extend into the internal auditory meatus, converting it into one solid mass.

Summary: A case of healed labyrinthitis secondary to meningococcus meningitis is reported. The late stages in the reparative processes are particularly emphasized.

1235 Park Avenue.

UNUSUALLY EARLY PLEUROPULMONARY SUPPURATION IN SINUS THROMBOSIS. A CASE REPORT.*†

DR. HARRY ROSENWASSER, New York.

Introduction: Sinus thrombosis, when it occurs in the early stages of acute otitis media, is a complication which may be diagnosable only with difficulty. Concomitant pleuropulmonary suppuration may serve to render the diagnosis even more difficult, because the attention of the observer tends to be focused upon the prominent clinical manifestations of this complication rather than upon the indefinite ones produced by an early sinus thrombosis. A case of this kind is presented in order to illustrate the difficulties of diagnosis, and to call attention to the result obtained, despite the fact that apparently an incomplete operation was performed upon the sinus.

Case Report: No. 379814. J. O., child, age 8½ years, was admitted on May 14, 1935, to the Surgical Service of Dr. Harold Neuhof. There was a previous history of measles, chicken pox, mumps, and repeated attacks of otitis. Eleven days before admission to Mt. Sinai Hospital, the patient who previously had been well, was awakened by severe earache. Temperature at that time was 105°. The next morning left myringotomy was performed at another institution. A small amount of thick pus discharged for a few days, but fever remained high and the patient seemed drowsy. Two days after onset of the earache, pain in the left chest, aggravated by deep inspiration, appeared. Respiration became grunting and the patient vomited continuously. There were neither chills nor cough. The temperature at this time was 105.6°. The patient was returned to the hospital where the myringotomy had been performed and remained there for one week. In the meantime X-ray examination of the chest revealed the presence of a left-sided pleural effusion. Aspiration of the chest on three successive days yielded "rusty" bloody pus. The last aspiration was performed four days before admission to the Mt. Sinai Hospital.

On admission, the patient, who was acutely ill, complained of sharp pain in the left chest; the temperature was 105.6°, the pulse rate was 140 and the respirations were 40 per minute. The alae nasi dilated with respiration. The physical signs were those of sepsis, bilateral acute bronchopneumonia and of an encapsulated empyema of the left pleural cavity. The white blood count was 25,200, 75 per cent polymorphonuclears, 17 per cent lymphocytes, 5 per cent eosinophiles, with toxic granules in all of the polymorphonuclears. The hemoglobin was 74 per cent.

Otological examination revealed the following: "The right middle ear appeared normal. The left drum was thickened and dull gray in color.

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†From Services of Dr. Isidore Friesner and Dr. Harold Neuhof, Mt. Sinai Hospital.

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All the landmarks were visible, and the hearing was acute." There was some tenderness below the tip of the mastoid which the otologist considered to be due to enlarged cervical glands. According to the history obtained the ear infection antedated the pleuropulmonary lesion only by 48 hours, therefore, it was thought unlikely that the latter was metastatic from the ear.

The following day the blood count revealed an increase in polymorphonuclear leukocytes from 72 per cent to 92 per cent and a slight fall in the hemoglobin; the total leukocyte count remained 24,000. Stab thoracotomy for encapsulated empyema was performed under anesthesia and thin fluid pus was obtained. Two days later, May 19, the patient complained of a sharp pain in the left lower quadrant which radiated to the left upper quadrant. This pain persisted and was quite severe. The abdomen became diffusely rigid and tender throughout. There was no abdominal distention. Rectal examination revealed generalized tenderness. Peritoneal aspiration was negative. Although the possibility of metastatic peritonitis was considered, the diagnosis could not be confirmed.

About one week after thoracotomy, May 24, the chest was aspirated again, and in the fourth interspace bloody fluid was obtained from which streptococcus hemolyticus bacilli was found on smear and culture. The hemoglobin fell to 64 per cent. There were no chills, the temperature varied between 99-105°, and the blood culture, which had been taken on admission, was reported negative. There was no cough, no sputum, no discharge from the middle ear and no palpable spleen.

Eight days after thoracotomy, May 25, the wound appeared clean and accordingly under-water drainage was discontinued. Despite the apparent control of the pleural infection, the hemoglobin continued to fall steadily. The following day, May 26, because of pain and tenderness about the upper end of the femur, this area was explored. Pus was obtained from the region about the trochanter. It did not appear to be coming from the bone. Three days later, May 29, the hemoglobin had dropped to 60 per cent, the temperature was still septic, varying between 99-104°. The patient was given a transfusion of 250 cc. citrated blood. An abscess involving the calf of the right leg opened spontaneously and drained thick pus.

Seventeen days after admission to the hospital it was noted that the patient had a definite bilateral papilloedema. A blood culture taken 23 days after the onset of the otitis was reported positive for streptococcus hemolyticus. The patient was seen by Dr. Friesner who stated that, in his opinion, a persistent bacteremia could in no way be explained by a metastatic focus, and that in view of the recent attack of otitis media followed by a sepsis with metastatic foci, bilateral papilloedema and tenderness over the emissary vein signified a sinus thrombosis. At this time the drum was of dull gray color, slightly thickened posteriorly, all the landmarks were visible, and there was no discharge from the middle ear.

Simple mastoidectomy with exploration of the left sinus was carried out under avertin anesthesia. Pus was found at once on removing the cortex. Considerable softened bone was present. Culture of the pus from the mastoid was positive for streptococcus hemolyticus. The plate over the lateral sinus was removed, exposing the sinus half way back towards the internal occipital protuberance. The entire sinus appeared gray and thickened. The sinus was incised but no free bleeding resulted. A purulent thrombus and a specimen of the sinus wall were removed. The incision in the sinus was extended down to the jugular bulb and posteriorly towards the torcula. There was no free bleeding to indicate that we had gotten to the limit of the disease process. Because of the poor general condition of the patient it was unwarranted to prolong the operation at this time. During the operation the patient was given a continuous

intravenous infusion of 5 per cent glucose, according to our routine, and this was followed by a 500 cc. citrated blood transfusion.

The next day, June 2, the patient's general condition was unchanged, the septic temperature persisted and the hemoglobin fell to 52 per cent. The blood culture remained positive for streptococcus hemolyticus. Five days after the sinus operation, the temperature still was septic and progressive bilateral papilloedema was noted. In addition, there was tenderness over the left trochanter. Aware that at the first operation the limit of the disease process had not been reached, a revision operation was undertaken. The skin incision was extended back as far as the external occipital protuberance. The bone over the lateral sinus was removed. The sinus wall was identified and incised on a grooved director. The vein was thrombosed and enormously thickened. A small fine rubber catheter was inserted into the sinus to make certain of its course. This catheter could be slipped into the straight sinus for a distance of three-fourths inch but no free bleeding resulted. The sinus was exposed towards the jugular bulb but neither bleeding nor pus was noted. The internal jugular vein was then ligated. Grossly, it appeared normal.

Following the operation, June 7, edema of the scalp developed over the occipital and parietal regions. The neck wound healed promptly. The hemoglobin began falling again and the patient was given another 500 cc. transfusion of citrated blood. The temperature still varied between 100-103°. On June 13 when the temperature rose suddenly to 103°, another blood culture was taken. Subsequently, this blood culture was reported negative. In addition there was pain and tenderness above the right knee joint. The left hip was still tender and swollen. The metastatic foci in the right hip, chest and right calf of the leg seemed to be clean and healing satisfactorily.

On June 15, about eight days after the last operation, there developed pain and swelling over the right shoulder. This was the most recent of the metastatic foci to become evident. The general condition of the patient appeared good. The patient was given another citrate transfusion. 250 cc., the temperature did not rise above 101.4° for the past two days and the tenderness over the right shoulder gradually disappeared. The papilloedema began to subside, the disc margins becoming discernible on the right side.

On July 6, five weeks after the final operation, the status of the patient was as follows: "The temperature has been varying between 99-99.8° for 19 days. The middle ear is dry and the patient is out of bed walking around. The postauricular wound is granulating and healing very nicely." A small fluctuant area developed on the chest wall adjacent to the old wound which necessitated revision. This was treated by opening the cavity and packing it with iodoform gauze. The patient was referred to a convalescent home for follow-up care. The follow-up after six months reveals that the patient is well.

Comment: As far as one can determine, a definite pleuro-pulmonary suppuration was present two days after the onset of the acute otitis. It is rather uncommon for metastatic foci to occur so soon after an acute middle ear suppuration. Lateral sinus thrombosis or phlebitis secondary to acute otitis and acute mastoiditis generally takes longer to develop. One can readily understand this because of the time that is required for bone to become involved. Occasionally there may be an extension of the acute infection from the middle ear directly to the jugular bulb through the thin or absent hypotympanum.

Whether a dehiscence in the hypotympanum existed in our case is conjectural.

When the patient was first admitted to our hospital there was no middle ear discharge, the drum was dull gray, and all the landmarks were visible. There was no papilloedema, the blood culture was negative, there were no chills, the spleen was not palpable — in brief, the existing pleuropulmonary suppuration seemed sufficient to explain the clinical picture; however, when the surgeons noted a streptococcus hemolyticus sepsis, despite what appeared to be adequate treatment of the pleuropulmonary process, the chest lesion was regarded as metastatic. By this time bilateral papilloedema had become evident, the spleen had become palpable, and some thickening and tenderness had developed over the mastoid emissary vein. Cultures of the blood and from the mastoid, pleuropulmonary focus, the hip, calf, all were positive for streptococcus hemolyticus B.

The extent of the thrombophlebitis in the lateral sinus was rather striking. The entire lateral sinus and straight sinus were involved. One can only guess as to the extent of the phlebitis beyond the area exposed. A soft small rubber catheter could be slipped into the lumen of the straight sinus for about three-fourths inch, but no free bleeding resulted. It was evident that we were not able to get beyond the area of thrombophlebitis in the straight sinus. Despite what was seemingly an incomplete operation, the evidences of sepsis gradually subsided and the patient recovered.

Metastatic foci often are observed clinically at varying times after the primary focus has been adequately dealt with surgically. At this point we wish to emphasize that metastatic foci in the chest, about the joints (hip, knee, shoulder) and in the soft parts, which are so often encountered in sinus thrombosis, are not causes *per se*, of a persistent bacteremia.

49 East 96th Street.

AUDIOMETRY AND THE PRESCRIBING OF HEARING AIDS.*

DR. ISAAC H. JONES and VERN O. KNUDSEN, Ph.D.,
Los Angeles.

Modern audiometry has emerged from the laboratory; it has withstood the criticism of the past 15 years and is now in a position to assume its place as a clinical art. So much has been reported by others, notably by Dr. Harvey Fletcher and other engineers of the Bell Telephone Laboratories, that we shall limit this paper primarily to our own work.

There has been a very sharp contrast between the ear and the eye. For many decades it has been possible to determine the precise condition of the eye of the patient. The ophthalmologist has recognized the need of a thorough knowledge of physiological optics and has devoted himself to a mastery of this subject. This has been feasible since optics has been an established clinical art. In colleges and universities elaborate courses are available for such instruction. In sharp contrast, physiological acoustics has received far less consideration. The available tests of hearing have been based on valid principles of physiological acoustics, but they have been limited in accuracy and scope, not only in studies of the frequency range, but particularly in the prescribing of hearing aids.

The eye has the great advantage in that we can see into it. The problem with the ear is to determine the condition of all those parts that we cannot see. In the past 20 years we have come to a better knowledge of the condition of these hidden structures. Curiously, this first came, not in auditory, but in vestibular studies. We then attained a method of testing the ear by observing objective responses from ear stimulation. This gave us findings on which we could rely — something definite which could be determined without the fallacies introduced by the patient's subjective feelings or ideas.

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Then came the hope of putting the auditory tests on a precision basis. Marked advancement in physiological acoustics followed the development of the thermionic vacuum tube and modern electroacoustic devices in telephone and radio communication. The result is that acoustics, applied to otology, may soon attain the dignity so long maintained by optics, applied to ophthalmology.

We must not forget that the application of optics to the clinical problems of the eye has been made possible by the invention, development, and use of precision instruments. An accurate diagnosis of eye lesions would today be impossible without the use of such instruments. The ophthalmoscope enables us to see the fundus of the eye and to study the media. The ophthalmometer reveals corneal curvatures; any difference existing between the curvatures of the two principal meridians is measured with accuracy. The retinoscope, used with lenses, enables us to measure refractive errors without the aid of the patient. It is an objective test.

Evidently the application of acoustics to otology required the invention, development, and use of precision instruments for the ear. What we needed was an "ophthalmoscope-ophthalmometer-retinoscope" for the ear. As the correction of refractive errors would be impossible without precision instruments, so the correction of auditory defects would be impossible without precision instruments. The audiometers of Dean and Bunch, and of the Western Electric Co. marked the beginning of these instruments of precision for the measurement of auditory defects. It occurred to the writers 13 years ago that audiometers should be better adapted to the needs of clinical practice. The following ideal requirements suggested themselves:

1. The need to determine how well the patient can hear amplified conversational voice and amplified whisper — both by air conduction and by bone conduction; also to provide different types and degrees of amplification to meet the needs of each individual patient. This would be indispensable in the prescribing of aids to hearing.

2. A convenient source of tone covering the frequency range from 128 cycles to the upper limit of hearing. The intensity range of each tone should extend from five to 10 decibels below the threshold of audibility (for the normal)

to within 10 or 20 decibels of the threshold of feeling. The intensity of these tones should be adjustable in steps of not more than five decibels each.

3. The test tones should be pure — free from all higher harmonics. This is particularly necessary for the tones of low pitch, since, for these tones, the ear may be more sensitive to some of the higher harmonics than it is to the fundamental tones.

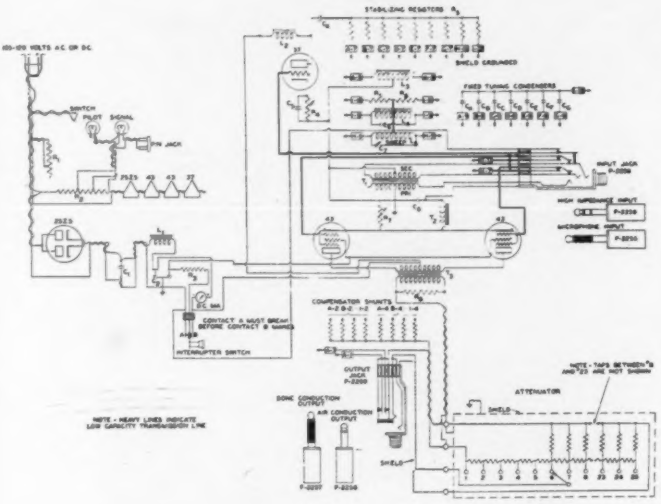


Fig. 1.

4. The hearing acuity for these tones should be measured by bone conduction, as well as by air conduction, throughout the entire range of hearing. Bone conduction measurements for frequencies above 2000 cycles are of special importance, because: *a.* The acuity by bone conduction for frequencies below 2000 cycles is influenced appreciably by lesions of the external or middle ear but is not influenced appreciably for higher frequencies;[1] therefore, when we make bone conduction tests above 2000 cycles, we are making a direct test of the cochlea. When both air conduction and bone conduction have

been measured and charted for the entire range of hearing, we then know just how much of the impairment is conductive and how much is perceptive. The air conduction tests furnish information regarding the composite condition of the entire hearing mechanism, including the external and middle ears; but for frequencies above 2000 cycles, the bone conduction measurements reveal the condition of the cochlea. The air

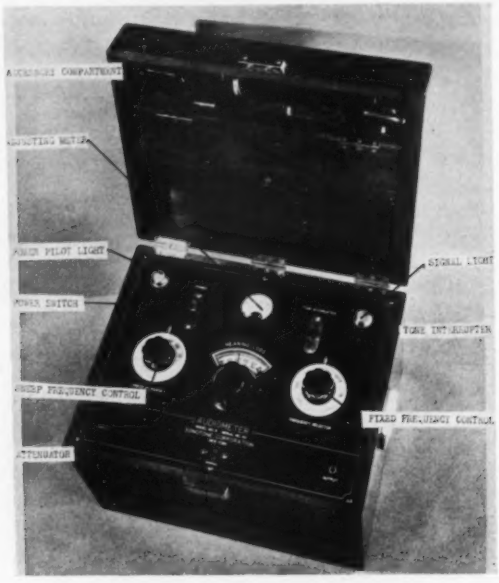


Fig. 2.

conduction gives the composite loss; the bone conduction, the perceptive loss. The difference between the air conduction and the bone conduction gives the purely conductive loss. *b.* Cochlear lesions usually result in a lowered acuity for frequencies above 2000 cycles. It is, therefore, particularly valuable to make such direct bone conduction tests of the cochlea at these higher frequencies.

5. A convenient noise apparatus.

6. It is imperative that all hearing tests be made in a very quiet place.

With the above principles and requirements in mind, the writers, 12 years ago, designed and constructed an instrument, the "audio-amplifier," which met the two prime requirements — diagnosis and the prescribing of hearing aids.[2] The particular feature of this instrument was the providing of an amplifier for conversational voice and whisper. The vacuum tubes in the instrument were used not only as an oscillator for the production of tones but also as an amplifier for conversational voice and whisper. The instrument further provided: *1.* Selective amplification of conversational voice, so that emphasis could be given to either high or low tones; *2.* a special type of telephone receiver for testing bone conduction from the low frequencies up to 4000 cycles; and *3.* a special noise apparatus.

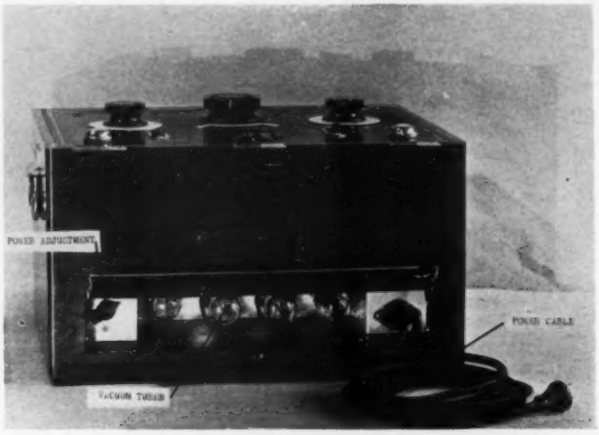


Fig. 3.

The value of this instrument in routine office practice caused others to request such an instrument. Twenty-five of these instruments were made and used in certain universities, hospitals, and private offices. During these 12 years suggestions

were received from those using these instruments; in addition, there have been important improvements in electro-acoustic devices which should be utilized in audiometers. As a result of these suggestions and improvements a new instrument is now completed, based upon the original audio-amplifier of the writers and further developed and improved in the Research Laboratories of the Sonotone Corp. (see Figs. 1-6. Those who have made significant contributions to the design of the instrument are acknowledged in the legends.) This new instrument has the following features:

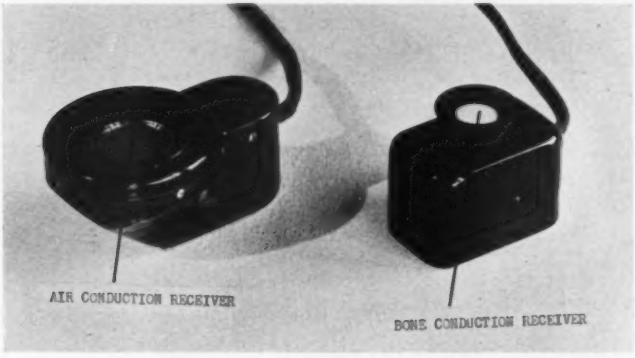


Fig. 4.

1. It operates from the house current, whether alternating or direct, instead of batteries. Suitable filters eliminate the "hum," so characteristic of radios and other instruments operated by alternating current. An indicator on the panel of the instrument assures a constant and definite operating voltage; this provides standardization of the tests, no matter where or by whom they may be made.

2. The oscillator provides pure tones of 128, 256, 512, 1024, 2048, 4096, and 8192 cycles, and also a continuous "sweep" of frequencies from 2500 cycles up to and beyond the range of human hearing. At all intensities (except those so loud that they are near the upper painful threshold), the tones are free from all harmonics; only the fundamental tones are audible.

3. A special electromagnetic receiver was developed for air conduction, which insures uniformity of the intensity of the test tones throughout a wide range of frequencies, and especially the "sweep" range between 2500 and 7500 cycles, where uniformity of intensity is a necessity for exploring tonal "dips" or sudden changes in acuity which so frequently characterize nerve impairments. In the usual telephone type of receiver, the resonant action of the diaphragm results in a wide variation in the intensity of tones of different pitch.

4. A new bone conduction receiver has been developed for this instrument. It is not influenced by the degree of pressure

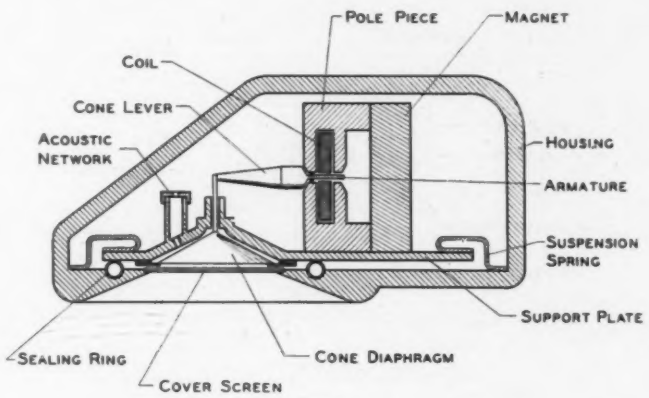


Fig. 5.

with which it is held against the head. It is shielded by a rubber flange which excludes hearing by air conduction. It reproduces tone throughout the entire range of hearing. A most attractive feature of the bone conduction receiver is its use for amplified conversational voice and whisper.

5. As a speech amplifier, the instrument constitutes in itself a "hearing aid." All possible graduations of conversational voice or whisper can be tested, both by air conduction and by bone conduction. Even without any other measurements — by merely talking to the patient — the otolaryngologist therefore knows at once: *a.* Whether the patient

hears well with a hearing aid; *b.* whether he hears better by air conduction or by bone conduction; and *c.* the degree of amplification by which he hears best.

Quantitative measurements of the extent of the patient's hearing, with different degrees of amplification, both by air conduction and by bone conduction, can be made by employing "speech articulation tests," similar to those used in the communication arts. Such tests are made by speaking into the microphone two sets of speech sounds, one of which incorporates typical vowels, and the other typical consonants. By counting the number of correctly heard speech sounds, one can assign a quantitative rating to each degree of amplifi-

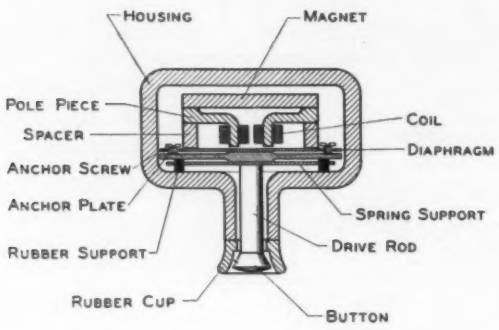


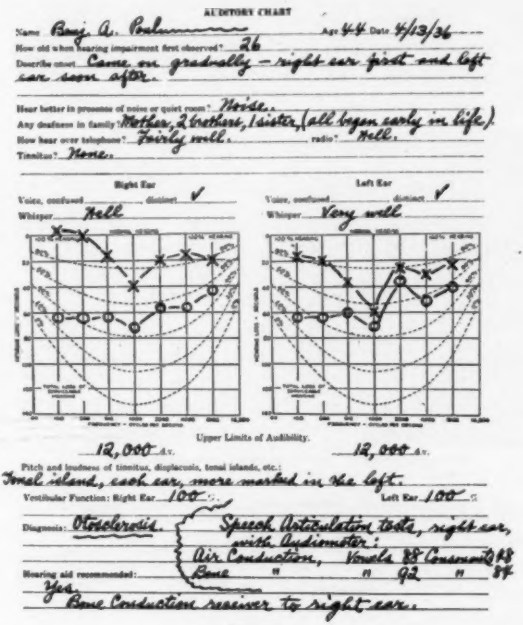
Fig. 6.

cation, testing first by air conduction and then by bone conduction. The microphone used for these tests is of the same type as those used in portable hearing aids. The speech as heard by the patient will then correspond with that which would be heard with commercial hearing aids of the portable type.

For research purposes, there should be provided a separate microphone as a special unit, such as is used in writers' laboratories. This may be used instead of the standard microphone, giving a higher quality to the amplified speech. This accessory unit should consist, not only of a high-quality microphone, but also of a preamplifier and suitable electric filters for providing different types of selective amplification. This will be useful not only as an instrument of research but in

prescribing the hearing aids of the future, as improvements occur.

In order to determine the usefulness of the audiometer in the prescribing of hearing aids, two of our associates, Mr. Norman A. Watson and Mr. Ludwig Sepmeyer, have been making an investigation of the entire subject of the hearing of amplified speech by the hard-of-hearing. The


AUDITORY CHART

Name Benj. A. Poole Age 44 Date 4/13/36

How old when hearing impairment first observed? 26

Describe onset Came on gradually – right ear first and left ear soon after.

Hear better in presence of noise or quiet room? Noise.

Any deafness in family? Mother, 2 brothers, 1 sister (all began early in life.)

How hear over telephone? Fairly well. radio? Well.

Tinnitus? None.

Right Ear — Voice, confused ____ distinct ✓ — Whisper Well

Left Ear — Voice, confused ____ distinct ✓ — Whisper Very well

Upper Limits of Audibility.

Right Ear 12,000 A.V. — Left Ear 12,000 A.V.

Pitch and loudness of tinnitus, diplacusis, tonal islands, etc.:

Tonal island, each ear, more marked in the left.

Vestibular Function: Right Ear 100 — Left Ear 100

Diagnosis: Otosclerosis. { Speech Articulation tests, right ear, with Audiometer: Air Conduction, Vowels 88 Consonants 83; Bone " " 92 " 84

Hearing aid recommended: Yes. Bone Conduction receiver to right ear.

Fig. 7.

technique of these tests is as follows: The patient is placed in a soundproof room so that he hears nothing but the sound coming through the audiometer and receiver. The examiner is in an adjoining room as he calls the lists of test words. He speaks at a distance of two feet from the face of the microphone. Tests were first made on those with normal hearing to determine the maximal articulation — to serve as a standard of comparison.

Similar tests have been conducted on patients with various types of hearing impairment. These tests are conducted both by air and bone conduction, and with various degrees of amplification. The pertinent results of these tests are shown in Figs. 7 and 8. Those portions of the chart used for the recording of the hearing acuity differ from the usual form. The hearing loss for each frequency is recorded directly from

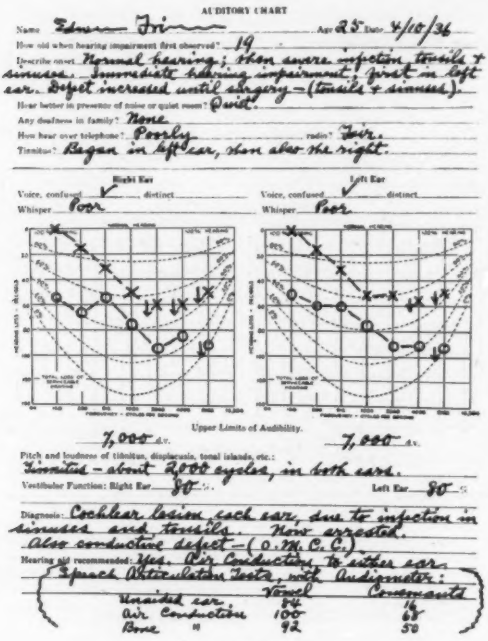

AUDITORY CHART
Name Edna Fri Age 25 Date 4/10/36
How old when hearing impairment first observed? 19
Describe onset Normal hearing; then severe infection tonsils & sinuses. Immediate hearing impairment; great in left ear. Defect increased until surgery - (tonsils + sinuses).
Hear better in presence of noise or quiet room? Quiet
Any deafness in family? None
How hear over telephone? Poorly radio? Fair.
Tinnitus? Began in left ear, then also the right.
Right Ear
Voice, confused ✓ distinct
Whisper Poor
Left Ear
Voice, confused ✓ distinct
Whisper Poor
Upper Limits of Audibility.
7,000 A.V.
7,000 A.V.
Pitch and loudness of tinnitus, displacusis, tonal islands, etc.:
Limited - about 2000 cycles, in both ears.
Vestibular Function: Right Ear 80 %
Left Ear 80 %
Diagnosis: Cochlear lesion each ear, due to infection in sinuses and tonsils. Now arrested.
Also conductive defect - (O.M.C.C.)
Hearing aid recommended: Yes. Air Conduction, to either ear.
Speech Articulation Tests, with Audiometer:
Vowel Consonants
Unaided ear 64 14
Air Conduction 100 69
Bone " 92 50

Fig. 8.

the audiometer dial — the straight horizontal lines indicating hearing loss in decibels; the corresponding hearing percentage is shown by the curved dotted lines; thus, no calculations are necessary, either in the recording of the decibel loss or in the interpreting of the percentage hearing. This form of chart was devised by Mr. Sepmeyer.

In prescribing a hearing aid, the following questions arise:

1. Should a hearing aid be prescribed at all? Perhaps the patient should be told, "You should not purchase a hearing aid because the amount of benefit you would get would not justify the expenditure of the money." A patient with less than 40 per cent of cochlear function does not derive an appreciable benefit from a hearing aid — in fact, he may suffer an actual injury. It is, of course, necessary to explain to him that the fault lies not in the instrument, but in the condition of his cochlea.

2. Should the patient have an air-conduction or a bone-conduction type of instrument? For example, he should have a bone-conduction receiver *a.* if he responds better to ampli-

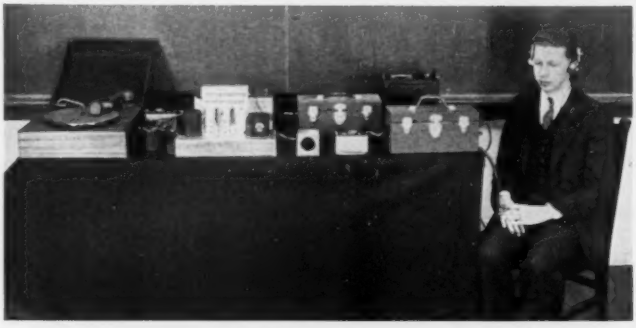


Fig. 9.

fied conversational voice by bone conduction; *b.* if the audiometric chart shows that bone conduction is much better than air conduction throughout the useful range of hearing; and *c.* if the speech articulation tests demonstrate that he *does* hear better by bone conduction.

3. How much amplification does the patient need? In conductive impairments, the "overload" of the instrument will be the limiting factor. In general, the patient will require as much amplification as the portable aid is capable of giving without distortion. There is little danger of overloading the cochlea, owing to the attenuation introduced by the conductive defect. In perceptive impairments, on the other hand, even with an ideal hearing aid, which itself is free from

distortion, the optimal amplification is critical — because the amplified sound soon reaches the upper painful limit. The amplification must be sufficient to allow both the vowels and the consonants to exceed the threshold of hearing but not so great as to introduce serious distortion, fatigue, or pain. High-quality amplification is especially necessary in perceptive cases.

4. Should a special high-quality hearing set be recommended? Recent experiments show that high-quality amplification should be used more extensively in the office, home, and other places where such nonportable or semiportable equipment can be installed. Such a high-quality set should consist of a microphone of the type used for radio broadcasting or the making of talking pictures; the amplifier should have a uniform response throughout a range of frequencies between 60 and 8000 cycles; and the receiver, whether for air or bone conduction, should have correspondingly high fidelity. Electric filters can be built into such hearing aids so as to suppress the low frequencies for those who have only "high frequency deafness." In an occasional case, it would be advisable to introduce electric filters to emphasize the low frequencies. It is gratifying to find that with equipment of this type it is possible to improve the hearing far beyond that which can be attained with the present portable hearing aids. For example, a patient having only 50 per cent of normal hearing, with the perceptive impairment predominant, shows an articulation in excess of 90 per cent. With the best type of portable hearing aid the highest articulation obtainable was 70 per cent.

5. Should selective amplification be recommended? In 1924, the writers reported experiments on selective amplification.[3] Since then, considerable attention has been given to the problem of hearing by selective amplification. Such experience as the writers have had with selective amplification has revealed that we are dealing with a problem of cerebration, and not merely with the physical problem of amplifying each frequency by an amount equal to the hearing loss at each frequency. This probably explains some of the statements patients have made, namely, that they hear as well with uniform amplification as they do with selective amplification. It is probable that continued use of the most appropriate

type of selective amplification would bring about the cerebral adaptations required for normal auditory perceptions. Certain patients do hear better by selective amplification, when they first use it.

We should not expect too much from selective amplification. The ear is so constituted that it can tolerate a large amount of distortion and yet understand speech very well. The amount of distortion introduced by the usual type of portable hearing aid is comparable with the distortion introduced by a hearing loss which is greater for some frequencies than for other frequencies. Such attempts as have been made by some manufacturers of hearing aids to control selective amplification by using different types of diaphragms in the microphones, or different types of electromechanical amplifiers, do not produce sufficiently large differences in the amplification characteristics to meet the requirements.

It is apparent that much remains to be done in perfecting hearing aids which will meet the requirements for each individual. It is certainly a mistake for a person who has good hearing for frequencies below 2000 cycles and greatly impaired hearing for frequencies above 2000 cycles, to use a hearing aid which amplifies only those frequencies below 2000 cycles. Yet this is what happens in many instances. Certain persons have nearly normal hearing for frequencies below 2000 cycles, and when such persons use the available types of portable hearing aid, they suffer from the excessive loudness. The hearing aid fails to amplify the higher frequencies, and in addition the overloud low frequencies actually mask the higher frequencies.

Selective amplification has promising possibilities for future developments in hearing aids. It is more than a theoretical idea; and it is probable that with future improvements and with continued use by patients, selective amplification for each individual will be provided in the routine prescribing and constructing of hearing aids.

At the present time, Mr. Watson and Mr. Sepmeyer are making further studies on selective amplification. Their work is supported, in part, by a grant from the American Otological Society, and by a grant from the American Laryngological, Rhinological and Otological Society.

The apparatus used consists of an electric phonograph, a volume control, with selective amplifier; a second volume control, and supplementary filter circuits; a small power amplifier, and a pair of high-quality ear phones (for air conduction) or an electrodynamic vibrator (for bone conduction) (see Fig. 9). The selective filters are adjusted in the best possible way to compensate for the hearing defect of each patient. Instead of using the voice of a caller, as in the tests with the audiometer described above, a special high-quality electric phonograph is used to produce standard speech sounds.[4]

Audiometry can not reveal the precise pathology of the structures of the middle or internal ear; however, it does reveal the useful facts of auditory function — giving us data for diagnosis and the prescribing of the best possible hearing aid. We have long been able to secure a precise knowledge of the function of the eye. The turning and caloric tests and precise audiometric measurements at least give us the key to a similar mastery of the ear.

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3. JONES, I. H., and KNUDSEN, V. O.: Functional Tests of Hearing. THE LARYNGOSCOPE, Sept., 1924.

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THE PERIOSTEAL FLAP IN THE PERFORMANCE OF MASTOIDECTOMY.*

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During the past three years we have employed the periosteal flap incision in all cases of mastoidectomy. Our results have been so gratifying as to warrant its description at the present time. This type of incision represents the only departure in the technique of simple mastoidectomy since the operation was first described by Schwartz in 1873.

The incision is started in the scalp, about one-fourth inch posterior to the hair line and is carried forward into the posterior root of the zygoma, on a level with the upper border of the external ear. The incision is extended downward, paralleling the curvature of the external ear, and then forward to the lower border of the tip of the mastoid process. The incision is thus located in the area covered by hair throughout its entire extent, except in its course forward to the tip of the mastoid process, a distance of about one-half inch. The periosteum is elevated forward along the line of the incision and carried forward until the posterior root of the zygoma, the posterior canal wall and the entire tip of the mastoid process is exposed. The flap is held forward with the aid of a small retractor, without the trauma to the wound edges as is encountered with the usual type of mastoid retractor. After the exenteration of the mastoid cells, the wound is packed lightly with iodoform gauze, the flap is replaced and the wound is closed except at the lower end. The packing is removed in 48 hours and is replaced by a small soft rubber tube, which is allowed to remain in place until all drainage from the middle ear has ceased. The average length of time required is seven to eight days.

By this procedure the mastoid process is covered with an intact layer of periosteum, thus affording a greater opportunity for bone regeneration and eliminating the usual post-

*At the time this paper was in the process of preparation, an article appeared in the March, 1936, issue of the Annals of Otology, Rhinology and Laryngology, by Dr. Jason Dixon, of Kansas City, who described an incision similar to the one described above.

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Fig. 1. Simple mastoidectomy, showing line of incision — seventh postoperative day.

Fig. 2. Simple mastoidectomy — two months postoperative.

Fig. 3. Simple mastoidectomy — three months postoperative.

Fig. 4. Acute mastoiditis — seventh postoperative day. Middle ear dry — granulation tissue lower end of wound.

Fig. 5. Acute mastoiditis — lateral sinus thrombosis — wound packed open — two months postoperative.

Fig. 6. Acute mastoiditis — two months postoperative.

auricular depression. The incision being placed in the scalp where there is a rich blood supply, and posterior to the infected mastoid cells, usually heals by first intention. Since the adoption of this method, there has been no breaking down of the wound in any of our mastoidectomies. The scar, being placed in the hair line, is rendered inconspicuous.

The period of convalescence has been materially reduced. The average stay in the hospital for the uncomplicated case has been seven days.

Fig. 7. Acute mastoiditis — lateral sinus thrombosis — wound packed open — four months postoperative.

SUMMARY.

1. A deviation from the usual type of mastoid incision is described.

2. The periosteal flap incision in the operation of mastoidectomy has the following advantages: *a.* The postauricular depression is eliminated. *b.* The mastoid scar is rendered inconspicuous. *c.* The time required for the healing process is reduced. *d.* "Breaking-down" of the mastoid wound is reduced to a minimum. *e.* A more adequate exposure of the mastoid operative field is afforded.

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NONMALIGNANT NEOPLASMS OF THE LARYNX.*

DR. GEORGE RENFREW BRIGHTON and
DR. SYLVESTER DALY, New York.

Nonmalignant neoplasms of the larynx covers a large field of pathological diagnoses, ranging from the most common, or papilloma, to those of the relatively rare type of rhabdomyoma. In this discussion we are limiting ourselves only to the more common types of tumors which apparently have been nonmalignant. In reviewing the literature, several interesting facts have come to light. Lennox Browne in his text book of nose and throat diseases, under "Benign Growths of the Larynx," states: "No throat infection has ever received such an amount of attention since the introduction of the laryngoscope as has been devoted to new formations in the laryngeal cavity." He refers to the voluminous works on the individual treatment of various laryngeal neoplasms by Czermak, Turck, Morrell, Mackenzie and Fauvel. Apparently, all of these men were writing in the last two decades of the Nineteenth century and each had his own particular approach to the treatment of laryngeal neoplasms.

It is our purpose in this paper to report a statistical study of the nonmalignant laryngeal neoplasms presenting themselves at the Presbyterian Hospital during the years 1930 to 1935, inclusive. We would like to state in passing that the diagnoses which we have accepted for this paper are based entirely on the histological study of the specimens removed. We have felt that if statistics are to be of any value in summing up the therapy, the clinical diagnosis of tumor is practically valueless. We believe very strongly in the close co-operation between the Department of Pathology and the Department of Laryngology in order to approach properly the treatment of these conditions.

In the series of cases coming to us during these years mentioned, the total number of cases operated upon was 82. During that period from 1930 to 1935, inclusive, the Nose

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and Throat Department at the Vanderbilt Clinic examined and gathered careful records of 30,460 new patients. Of the 82 cases operated upon, 43 per cent were histologically diagnosed as papilloma; 16 per cent as hemangioma; 12 per cent as polyp; 11 per cent as cyst; 6 per cent as myxoma; and the remaining 12 per cent included fibroma, plasmocytoma, rhabdomyoma and the more unusual tumors. Of this total number, 64 per cent occurred in males and 36 per cent in females. The average age of this group was 35 years. The location of the tumors was found to be 26 per cent in the right vocal cord; 36 per cent in the left vocal cord; 16 per cent in the anterior commissure; 7 per cent on both vocal cords and the remaining 15 per cent were scattered through the larynx. It is obvious when we report the average age of this group as 35 years, that we are here not dealing with the infantile or adolescent type of papilloma. We are, therefore, interested only in that group of tumors which occur during the fourth decade in life.

In this group the papilloma, as we have stated, occurred in 43 per cent of all of the patients. This checks up fairly with other investigators who have found the tumors occurring in from 39 to 50 per cent. Semon in his report in the study of a large number of benign tumors reports a 39 per cent incidence. Mackenzie reported the figure as high as 67 per cent and Schnitzler states that it is the most frequent of all laryngeal growths. Apparently also the papilloma is practically without discussion from the standpoint of the pathological diagnosis. It would seem that all pathologists are in agreement about the histological structure of the papilloma. The following is the description of a typical case:

"*Papilloma of Vocal Cord:* This consists of heaped up, thickened, finger-like projections of stratified squamous epithelium resting on narrow connective tissue cores bearing blood vessels. The basement membrane of the epithelium is well demarcated and there is no infiltration of the underlying stroma by small groups of epithelial cells. The epithelium is well differentiated and shows no variation in size, shape, and staining properties. A rare mitosis is seen."

The next most frequent tumor which we have encountered has been the hemangioma. As we have said, this occurs in 16 per cent of all of the cases, but apparently is not accounted

for as frequently in other studies as in our own. The probabilities are that this is simply a difference in the pathological diagnosis and that this is a tumor which contains a fair amount of vascular structures. Our pathologists have made this diagnosis whenever the vascular spaces were fairly frequent. A description of a typical case is as follows:

"*Capillary Hemangioma of Larynx:* This consists of a globular mass of loosely arranged connective tissue containing many thin-walled blood vessels. Some of these are thrombosed. Areas of hyaline degeneration and hemosiderin are seen in the stroma. The mass is covered on the surface with normal stratified squamous epithelium."

The next tumor is the polyp which occurred in 12 per cent of our cases and the pathological description of a typical polyp is as follows:

"*Polyp of the Larynx:* This consists of a layer of stratified squamous epithelium covering a mass of loosely arranged connective tissue bearing dilated thin-walled blood vessels and infiltrated with a few round cells and plasma cells."

The cyst occurred in 11 per cent and the pathological description of a typical case is quoted:

"*Cyst of Vocal Cord:* This is composed of a collapsed cyst lined by stratified columnar epithelium showing no hyperplasia. In the lumen are a few desquamated cells. The lining epithelium rests upon a thin layer of loosely arranged connective tissue, on the outer surface of which there rests a thin layer of stratified squamous epithelium."

The myxoma occurred in 6 per cent of the cases and the pathological description of a typical case is as follows:

"*Myxoma of Larynx:* This consists of a surface layer of stratified squamous epithelium resting upon a globular mass of loosely arranged, edematous connective tissue in which there is some myxomatous degeneration."

When one attempts to predicate the etiology of these tumors, there seems to have been a general agreement among laryngologists that hyperemia is undoubtedly the site of most of these new formations and, therefore, everything which tends to excite congestion will naturally predispose to their production. Most observers also are reasonably emphatic about alcohol, tobacco and abuse of the voice. Since it seems in

all of the statistics that this type of growth is more frequent in males than in females, one would assume that improper use of the voice probably was one of the most important predisposing factors to these new growths. Also in recent years more attention has been paid to nasal and nasopharyngeal obstructions and sinus disease in considering the possible etiological factors causing these tumors. It is difficult, though, in such a small series to be definite regarding causative factors; however, I think we should all consider abuse of the voice and improper use of the voice superimposed upon the acute inflammatory reactions in the upper respiratory areas, as one of the most important predisposing factors to the development of laryngeal new growths of benign character. There is plenty of room for investigation into the etiological factors of these conditions.

TREATMENT.

The treatment of benign new growths of the larynx in recent years has become more or less standardized. Since the common use of the direct laryngoscope, most of these tumors are approached by direct laryngoscopy. There are few of us who have entered laryngology in the last 10 years who are able to remove them successfully by indirect method, as all of our training has been by the direct approach; however, each case must be decided upon its own merits. By that, I mean, to decide whether the surgical approach should be undertaken immediately or whether one should assume that the small tumor observed by the mirror might atrophy and be absorbed if the patient were given complete and absolute rest of the larynx. Many times one will see small shiny tumors on the edge of the vocal cord with a very short history of huskiness and if the patient is given complete and absolute rest, that is, absolutely no phonatory efforts whatsoever for a month to six weeks, the tumor will gradually disappear and the clarity of the voice will return. It is important, certainly, for the laryngologist to keep these patients under observation at least once a week during the rest period. If the tumor shows any evidence of increasing in size, a direct laryngoscopy should be done at once and the tumor removed and histological study made of the specimen.

In the cases of hemorrhage into the cord, which one frequently sees in the fall of the year, at the football season,

most of them will be relieved in a very short period by complete rest of the larynx, abstinence from alcohol and smoking. It is important, though, that they should not be dismissed with those simple instructions, because not infrequently a small tumor will develop at the seat of the hemorrhage. These patients should be kept under observation until the vocal cords are clear and the clarity of the voice has returned.

In the large pedunculated growths which one sees coming either from the edges of the vocal cord, the under surface of the vocal cord, the anterior commissure or ventricle and which move about the larynx on phonation and respiration, rest seems to have little effect. The approach to the treatment of these tumors is, first, mirror examination with as accurate observation as is possible to determine the site of the origin of the tumor; then direct laryngoscopy and removal of the tumor at its base. It is particularly important in handling a case of this character that none of the very delicate structures of the larynx be damaged by the forceps in removal. In the tumors which occur on the ventricular bands, on the inner surface of the epiglottis and in the posterior commissure, direct laryngoscopy with removal is a procedure of choice.

Many of the papillomatous tumors which are villus in character have a tendency to recur. This tendency to recur should in no way disturb the operator, provided that every section taken from the larynx is very carefully examined by his pathologist. One should not feel that his laryngoscopy with removal has been a failure simply because the papillomatous tumor has recurred. Many of our cases have had as many as 15 to 18 removals of these nonmalignant growths, two cases in the series showing development of malignancy in the larynx. It is exceedingly important that not one piece of tissue which has been removed escape histological examination. A competent pathologist must be at hand to evaluate not only the structure of the tumor but also the character of the cells, the number of mitoses present and the character of the basement membranes. If each section is carefully studied and the patient kept under very careful observation, the earliest sign of malignancy, if it should be present, will be discovered and steps can then be taken accordingly.

It might be well when one is discussing treatment of these benign tumors to outline in detail the hospital procedure

necessary to follow these cases carefully. The cases are first admitted to the general nose and throat section of Vanderbilt Clinic for examination of the nose, throat and larynx. Any associated sinus disease is corrected and any general difficulties in the air passages also corrected. The cases are then referred into the hospital, where a careful history and physical is taken and any associated diseases noted and treated. Direct laryngoscopy is done in our usual Bronchoscopic Clinic and the sections which are removed are immediately sent to the pathologist for his fixation. When the patient is discharged from the hospital he is returned to the Vanderbilt Clinic and his hospital chart goes with him. Frequent observations are made with a mirror in the Out Patient Department and if there is any evidence of recurrence of the tumor, the patient is immediately referred back to the Bronchoscopic Clinic for further removal. These patients are never discharged from the hospital or the Vanderbilt Clinic as long as there is any difficulty with the voice but are always kept under observation. When the voice is completly cleared and there is no evidence of recurrence of the tumor, the patient is then told that he need not report for from three to six months. In the follow-up of these cases we have been particularly fortunate in keeping the confidence of our patients and having them return to us, with only a few exceptions, for continued treatment. We impress upon them the importance of any change in the voice and tell them very frankly that these small tumors should be immediately taken care of if they recur. I think that this is probably one of the reasons why our results seem to be exceptionally good.

RESULTS.

The results of our statistical study and treatment of these tumors will be taken up by histological diagnosis and years.

Papilloma: 1930-31. Fifteen cases of papilloma of the larynx treated; 13 months average follow-up. Four cases unimproved and remaining cases definitely improved with no recurrence. In other words, 26 per cent of the cases were not improved at the end of 13 months.

1932. Three papilloma cases seen; 13 months average follow-up and all cases were improved.

1933. Five cases of papilloma; 15 months average follow-up. One case unimproved.

1934. Three cases of papilloma; five months average follow-up. Two cases unimproved.

1935. Three cases of papilloma; three months average follow-up. All cases improved.

Seventy-one per cent of the cases of papilloma during the six years were improved, with an average follow-up of 9.8 months.

Hemangioma: 1930-31. One case of hemangioma; 36 months follow-up. Improved.

1932. Two cases of hemangioma; two months follow-up on one case and no follow-up on the other. One case improved.

1933. One case of hemangioma; two months follow-up. Improved.

1934. Three cases of hemangioma; 17, 24 and 24 months follow-up. Two cases improved. One case unimproved.

1935. Two cases of hemangioma; one month follow-up on one case. One case improved.

Sixty-six per cent of the cases of hemangioma improved; 33 per cent unimproved with 11.6 months average follow-up.

Polyp: 1930-31. No case of polyp encountered.

1932. Two cases of polyp; three months follow-up. Both cases improved.

1933. No case of polyp encountered.

1934. Three cases of polyp; two months, 16 months and two weeks follow-up. All cases improved.

1935. Three cases of polyp; seven, two and seven months follow-up. All cases improved.

Average follow-up, 4.4 months; 100 per cent improved.

Cysts: 1930-31. Two cases of cysts; three months and one month follow-up. Both improved.

1932. One case of cyst; 36 months follow-up. Improved.

1933. One case of cyst; 30 months follow-up. Improved.

1934. One case of cyst; 21 months follow-up. Improved.

1935. Two cases of cysts; 14 months and five months follow-up. Both cases improved.

Average follow-up of 15.7 months; 100 per cent improved.

Myxoma: 1930-31. No case of myxoma encountered.

1932. One case of myxoma; no follow-up.

1933-34. No case of myxoma encountered.

1935. One case of myxoma; one month follow-up. Improved.

Rhabdomyoma: In 1934 one case of rhabdomyoma was encountered by Dr. Kernan and Dr. Cracovaner and has already been placed in the literature.

Plasmocytoma: In 1932 one case of plasmocytoma was treated with two months follow-up. Case not improved.

Our purpose in using the terms "improved and "unimproved" in reporting the follow-up in these cases is simply because we feel that one can never be sure that a nonmalignant tumor of the larynx will not recur. We specifically mean by "improved" that the vocal cords were clear, there was no evidence of tumor and the clarity of the voice had returned. The cases which were called "unimproved" had either evidence of recurrence or there was considerable edema of the larynx, obscuring the normal clarity of the voice and, therefore, not anatomically cured.

CONCLUSIONS.

I should like to take this opportunity in conclusion to thank Dr. J. D. Kernan and Dr. A. Cracovaner for the permission to use their cases in this article. The total number of cases represents the combined efforts of all of us on the staff doing bronschoscopy, and the careful observation of the staff of Vanderbilt Clinic.

If we are to draw any definite conclusions from a statistical study of this nature we must consider the most important features in the care of a patient with a nonmalignant tumor to be: *First,* histological study of the tumor removed. *Second,* careful attention to the upper air passages. *Third,* proper instruction in the use and care of the voice. *Fourth,*

proper follow-up. *Fifth* (and most important), careful, gentle surgical removal of the tumor with the direct laryngoscope.

The fact that so many of these tumors occur in the male population should remind one to instruct carefully all of his male patients with sinus disease, chronic tonsillitis or chronic nasopharyngitis in the proper use of his voice.

We are not in accord from this short series with many of the men of the older school who felt that tinkering with benign tumors of the larynx led to cancer development. We feel very definitely that the onset of a benign tumor in the middle decade of life should be regarded as a serious situation until it has been very definitely proven, by complete removal and no recurrence, that the tumor is not malignant.

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CONGENITAL STENOSIS OF LARYNX.*

DR. GEORGE HUNTER O'KANE, New York.

The patient was a girl, born at full term. Spontaneous delivery, vertex presentation; position left occiput anterior. At birth the patient weighed 2,680 gm. The course of pregnancy in the mother, age 23 years, who was a primipara, was normal. The duration of labor was 23 hours and 35 minutes. The father, age 28 years, and the mother were in good health. The family history was otherwise negative.

At birth it was noted by the obstetrician, Dr. Terkuile, that respirations were crowing in nature with apparent obstruction. It was also observed that there was no molding of the head, no scalp nor skull injury, and that the baby was apparently normal except for marked stridor immediately after delivery, which persisted even after some meconium stained mucus had been aspirated from the pharynx. The stridor and dyspnea persisted after further attempts at aspiration, and since there was no evidence of improvement in respiration, it was decided to consult the laryngologist.

When first seen, two hours after delivery, the reported finding of meconium in the pharynx suggested mechanical obstruction as a result of aspiration of meconium. With this in mind, the laryngoscope was passed and the larynx brought into view. The epiglottis, arytenoids, cords and aryepiglottic folds did not present any appearance that could be interpreted as abnormal for a patient of this age. It was felt, however, that there was some limitation in movement of the cords. No webs or adhesions were noted; moreover, there did not seem to be sufficient foreign matter about the larynx to account for the obstruction.

It was assumed that meconium might have been aspirated into the larynx and trachea, so with the larynx in direct view, the tip of a small catheter was introduced between the cords to suck out any foreign material which might be present. As

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the tip of the catheter was introduced it met with obstruction just within the subglottic space. In an effort to determine the nature of the obstruction, an attempt was made to introduce a 3 mm. bronchoscope. The lip of the bronchoscope was introduced between the cords, but seemed to encounter obstruction just below the cords and it soon became evident that the scope could not be safely passed, either because of disproportion between the size of the scope and the larynx or subglottic obstruction.

In the interval between the above mentioned maneuvers, CO_2 10 per cent, oxygen 90 per cent were administered by means of a closed mask. In spite of this treatment the dyspnea and cyanosis seemed to increase and it became apparent that the infant was rapidly becoming exhausted. We had hoped to employ Dr. Barach's helium and oxygen therapy, but the condition of the patient seemed so critical at this point that it became manifest that prompt relief of the obstruction was indicated. Accordingly, tracheotomy was done and a No. 1 tracheotomy tube inserted with immediate relief of dyspnea as evidenced by rapid disappearance of cyanosis and the establishment of normal respiration.

No further operative procedures were attempted until Aug. 29, 1935, at which time a direct laryngoscopy was done. The examination was unsatisfactory. Nothing definite regarding the pathology was determined.

In order to obviate ulceration of the trachea, No. 1 tracheotomy tubes of various lengths were used in rotation, so that there would not be continuous pressure of the end of the tube at any one point in the trachea for more than 24 hours at a time. The tracheotomy tube was changed once a day and the area in and about the wound suctioned with a small rubber catheter.

A series of Roentgenograms, made by Dr. Caffey, of Babies Hospital, were of inestimable help in guiding and following the subsequent course of the patient.

P. C., born Aug. 20, 1935.

Aug. 21, 1935: P. A. and lateral of chest. Essential findings: Larynx contained very little air. Trachea well outlined and does not appear narrowed or deformed.

Aug. 23: Fluoroscopic examination of chest. Absence of air in the larynx.

Sept. 16: P. A. and lateral of chest. Lung fields are clear. Heart shadow is normal. Tracheotomy tube too long. Danger of ulceration stressed.

Sept. 19: P. A. and lateral of chest. Age 1 month. Tracheotomy tube shorter. Lung fields remain clear.

Oct. 14: P. A. of chest. Age 2 months. Lung fields clear. Cardiac shadow normal.

Oct. 30: P. A. and right lateral of chest. Stenosis of the trachea just below the distal end of the tracheotomy tube. Longer tube suggested. Lung fields are clear.

Nov. 13: Fluoroscopic examination of chest. Age 2-1/3 months. No evidence of obstruction noted on Oct. 30 seen.

Nov. 30: P. A. of chest. Lung fields are clear. No cause for cyanosis seen.

Dec. 17: P. A. of chest. The air content of the left lung field is better than on the right. In the medial right lower there is a small patch of increased density which fills the angle between the right heart border and the diaphragm. Impression: Developing atelectasis on the right, associated with tracheotomy tube. A shorter tube or frequent changing of tube suggested.

Blood and urine, no significant findings. Weight at birth, 2,620 gm. Weight March 16, 5,510 gm.

The subsequent clinical course of the patient has been smooth. She has gained steadily in weight from 2,680 gm. at birth, to her present weight of 5,410 gm. All attempts to block the tube or the tracheotomy opening, even up to the present time, have resulted in severe dyspnea.

COMMENTS.

The exact pathology which we feel we have established as subglottic is still questionable. This case resembles very closely one reported by Dr. Gabriel Tucker. Dr. Tucker's case was a child, age 4 months, with a congenitally small glottic lumen. This case was suffering from a suppurative pneumo-

nitis when first seen, and although tracheotomy was done and the dyspnea relieved, the patient ultimately died from pneumonitis. Postmortem examination showed the larynx to be normal in every way except that the dimensions were abnormally small. There was no other cause discovered for obstructive dyspnea.

Dr. Tucker also mentions the occurrence of webs across the anterior commissure and webs surrounding the glottic margin with a central lumen as a cause of congenital stridor that persists from birth.

Dr. Heatley, of Rochester, reported a case of laryngeal stenosis due to congenital redundancy of the normal subglottic mucous membrane. Dyspnea came on in this case *not* at birth but at about the age of 6 weeks and was relieved by tracheotomy. Dr. George Brighton, of this clinic, has a similar case of identical pathology in an infant weighing seven pounds. In Dr. Brighton's case dyspnea became severe at about the age of 6 months. It became acute following bronchoscopy and was relieved by tracheotomy. The tracheotomy tube was finally removed at the age of 3 years and the child is alive and well today.

Other cases reported in the literature include eight of congenital relaxation of the larynx, one of tracheal subglottic diaphragm and one of multiple papilloma of the larynx.

The X-ray studies and the relief of dyspnea following tracheotomy in this case is against a diagnosis of pressure on the trachea from an enlarged thymus or a tumor of the thymus. There are numerous reports in the literature of stridor presumably due to this cause, as R. W. Wilkinson points out in a recent article on congenital stenosis of the larynx (*Jour. A. M. A.*, 102:1756, May 26, 1934):

"True congenital stenosis of the larynx is limited to atresia bands or webs within the glottis, involving the vocal cords, ventricular bands or arytenoids, and is permanent unless relieved surgically." In this particular case where the onset of the dyspnea occurred at birth, it should fall into one of the above categories, congenitally small glottic lumen or a web within the glottis.

We know that embryologically there is a period of fusion of the structures of the glottis during gestation. This is prob-

ably to prevent the passage of the amniotic fluid into the respiratory tract. At about the eleventh week of embryonic life the arytenoid folds separate, followed by parting of the superior and inferior folds to form the ventricular bands and the true vocal cords. Congenital laryngeal stenosis as exemplified in this case may be due to incomplete separation of these processes during fetal life. The lack of separation becomes apparent at birth when the infant is obliged to use his own respiratory mechanism to sustain life.

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116 East 53rd Street.

DEMONSTRATION OF NEW TYPE OF TRACHEOTOMY TUBE—THE MIKELL TRACHEOTOMY TUBE.*

DR. JOHN S. MIKELL, New York.

I am presenting at this time a new type of tracheotomy tube which has been developed at the Medical Center during the past several months. Its construction is so simple and advantages so evident, it will require only a few minutes to present this article.

The sole idea in its construction is to follow the first principle of surgery — that is, to give the surgeon the best possible view of the operative field at all times.

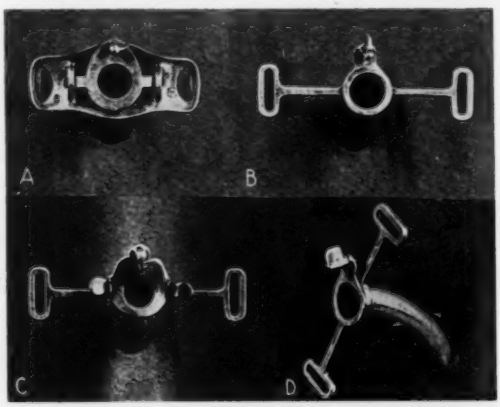

Fig. A shows the tube in general use, and Fig. B the new tube. It takes only a moment of comparison to show you that we have accomplished this purpose.

In its construction the large movable wing was detached and the head of the tube narrowed down to about one-eighth of an inch. The attachment of the inner tube was left intact but also narrowed. A ring with the two narrow projections,

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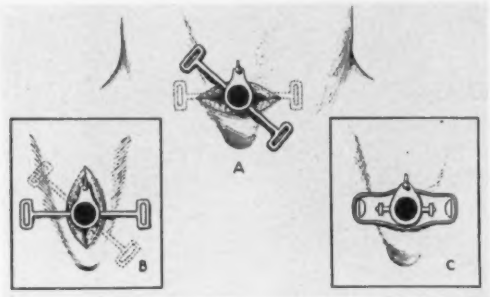
or arms, was cut from a piece of silver. Each arm has at its end a loop which permits the attachment of tape. This ring was slipped over the inferior portion of the tube and held in place next to the head by four silver pegs.

The final product is a tube with a very small "head" that hides only a very small portion of the field; it is permanent and has as its support two narrow arms which revolve to further increase the view of the operative field.

Now the ideal tracheotomy is one in which there is no emergency element, in which we can infiltrate and do a careful dissection. The bleeding points are located, clamped and ligated before the tube is inserted. When there is more of an emergency element involved we can establish an airway by passing a bronchoscope and then doing our careful dissection. In both types of cases an emergency is likely to arise



where the careful technique will have to be discarded and an airway established, regardless of the bleeding. In these emergencies, as well as in the cases where we have neither the time nor the means to do such careful surgery, the bleeding is always a problem.

During the last tracheotomy done at the Medical Center the above mentioned emergency arose. An airway was immediately established and the bleeding points tied at the deepest portion of the wound and ligated with the tube in place.

Fig. 2 contains drawings which were made at operation. These illustrations demonstrate the previously mentioned advantages.

Made by George Tiemann & Co.

Columbia Presbyterian Medical Center.

NEW NASAL AND AURAL APPLICATORS FOR HEAT THERAPY.

DR. CONRAD K. GALE, New York.

We wish to describe and explain two new types of nasal and one aural applicator which can be used with any apparatus incorporating the Elliot water circulation principle. Hitherto, this form of therapy in its application to nasal and sinus therapy has been inadequate because of failure to recognize the importance of nasal anatomy in relation to the nasal applicators. We have only been able to find one form of nasal applicator and this merely a rubber tube, approximately ¼ in. in diameter, which, when inserted, lies on the floor of the nose. Obviously, its limited contact with the nasal mucosa detracted from its efficacy. Our purpose was to construct applicators which would have a maximum contact with the nasal mucous membrane. When it is recalled that all the sinuses form immediate boundaries of the nasal cavity, a heat application to as large a surface as possible would have a maximum effect. Since this paper is limited to a description of the applicators, the physiological effects will be left for a future date.

The first applicator, while applicable to the anterior sinuses, is particularly designed for treatment of the posterior ethmoidal cells, the sphenoid, and the retropharynx, including the Eustachian orifice and tube.

Diagram I: (A) Carrier tube, 3/16 in. in diameter, made of nondistensible rubber. It is divided into two sections to permit flow and return flow of the heated solution. The carrier tube may be inserted into the nose for a distance of about ½ to 1 in.; its narrow diameter permitting it placement either in the inferior or middle meatus.

(B) Applicator proper consisting of thin distensible rubber which balloons out under pressure. It is somewhat oval in shape, tapering at its distal and proximal ends. The adult length is about 2¼ in. and varies with the age and nasal

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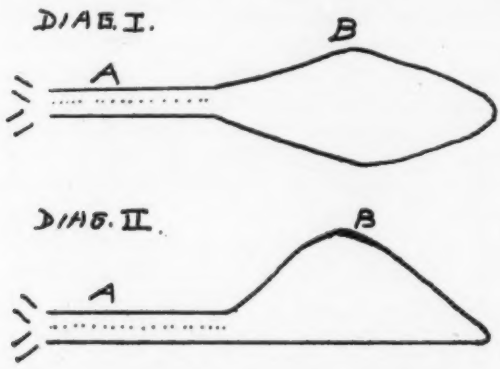
construction of the patient. On first thought the introduction of a thin collapsible rubber applicator would present many difficulties, but this is not the case. Insertion of the applicator is extremely simple when the following technique is employed: Before inserting the applicator into the nose, it is permitted to partially balloon out under mild pressure. Now, holding the distal end of the applicator firmly on the stretch from the proximal end, the pressure is released and suction applied. This brings the walls of the applicator closely together so that it has both the appearance and thinness of a jack-knife blade, yet with sufficient rigidity to be easily inserted even when moderately marked nasal obstructions are present. Once inserted into the nose its location is optional, but it is partic-



ularly designed for posterior ethmoidal, sphenoidal, and retropharyngeal application. When in place the applicator is permitted to balloon out under pressure until the point is reached where the patient complains of discomfort. As the applicator balloons out gentle traction is made on the carrier tube. It will be found that traction on the carrier tube will not dislodge the applicator which is now firmly wedged into position because of its ballooning; this traction, at the same time, prevents the applicator from slipping down into the nasopharynx. Treatments have a minimum duration of 20 minutes, with water temperatures approximately 125° F. during treatment, while initial starting temperature is about 112° F.

The second type of applicator is used more for the anterior sinuses, catarrhal conditions, and particularly for ozena. It is,

of course, perfectly possible by intelligent usage to apply the balloon type of applicator for these conditions.

Diagram II: (A) Carrier tube. (B) Applicator proper, which is shaped to conform with the average contours of the nasal cavity. It is *not* ballooning, but will distend under pressure. Its form is constant and secures the largest possible contact with the mucous membrane of the nasal cavities. In position it is in contact with the limiting walls of the antrum, ethmoid, and at times with the floor of the frontal sinuses. In ozena cases, particularly, the largest applicators may be used, giving a maximum action on the atrophied mucosa. The technique of insertion follows exactly the method used with the ballooning applicator. There is, however, this modification. After suction has been applied and the applicator is very thin, it can be rolled up, probe fashion, and inserted into the nose. By connecting the upper bifurcation of the carrier tube to the pressure outlet of the apparatus, we find that the applicator snaps into position when the heated solution is released into it. Our chief purpose in aural applications has been to apply heat directly to the surface of the drum. The stiff rubber tube now used causes pain when passed against the drum; and allows of no adjustment to the anatomical position of the drum. To this end we have devised the following applicator having a carrier tube, which is inserted into the external auditory meatus. Because of the thinness of the carrier tube, heat is transmitted to the walls of the external auditory meatus. At the end of the carrier tube is a small oval applicator, which is of the ballooning type. After the carrier tube is inserted to within $\frac{1}{4}$ in. of the ear drum, pressure is applied to the applicator. The applicator, in turn, balloons out, very gently, and without great firmness, establishing painless contact with the surface of the ear drum. In this way direct heat therapy is applied to the drum and middle ear, and by conduction to the contiguous structures. We believe that the perfection of these applicators opens up new possibilities for direct heat therapy in the nasal, retropharyngeal and external auditory cavities.

40 West 86th Street.

NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTO-LARYNGOLOGY.

Meeting of April 15, 1936.

DISCUSSION.

The Incidence of Sinusitis and Nasal Polypi in Bronchial Asthma.
Dr. Samuel F. Kelley.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DR. JOHN DEVEREUX KERNAN: This certainly is a beautifully worked up paper. I would say that anything which is so universal, involving all ages as asthma does, is of interest to all physicians; and, on account of the frequency with which nasal disease is found in cases of asthma, of particular interest to us as oto-laryngologists. I am tremendously impressed by the co-operation which Dr. Kelley has had from the X-ray men, laryngologists, allergists and internists, etc. That represents the kind of work that must be done before this problem is solved; chemistry also will come in. As you know, there are certain members of our specialty who place great emphasis on the color of the mucous membranes and the reaction, whether alkaline or acid, of the nasal secretions.

I would like to call your attention to the 11 per cent who had nothing pathological in their noses. That means, of course, that one can have asthma entirely unrelated to nasal disease, and you wonder to what they are due. It means that they are due to some cause which is not inhaled, some cause developing within the body. It would suggest that asthma is something entirely independent from the nose, at least in those cases. When you think of asthma as entirely independent of the nose, you wonder where we come in at all. If asthma can be independent of the nose, and if in a good many cases of asthma with disease in the nose it is merely concomitant and they just run along together, then you wonder if the oto-laryngologists have anything to do with asthma at all and whether there is really any object in examining these noses.

It will be noticed that there are three classes of cases; roughly, the inflammatory — those that have pus infections, the allergic, and those that have nothing in the nose at all. I would like to ask the essayist if he noticed any difference in these three classes of cases. Was the asthma, for instance, more or less severe in cases in which he found pus, or in which he found polyps, or in which he found hypertrophic membranes, or in which he found nothing at all? I would like to ask him whether relieving the inflammatory conditions, washing out the pus, removing polyps, and so on, has anything to do with relieving the asthma? I have seen a good many cases of asthma operated on and polyps removed, and extensive operations done on the nose — everything from exenteration intranasally to the most extensive kind of external operations, both frontal sinuses and both ethmoid regions being cleaned out and even the antra operated on. It seems incredible that people can survive all that, but they do. I have seen all that done without any relief of the asthma. That is where the work is going to come in, to find out which of these cases that show nasal pathology will be helped by local nasal treatment. Is it worth while operating at all? Of course, if you see polyps in the nose or a patient has pain and a nasal discharge of pus, naturally, you would operate on such cases whether there was asthma or not. But suppose a case has asthma and no particular nasal symptoms, are you going to operate on those cases? To sum this all up, my idea is this: Suppose you do find a lot of stuff in the nose, what of it? Dr. Kelley is going to do a lot more work and research on these cases before he can answer that one. Nasal pathology is almost universal in asthma. What

of it? Should we treat them all, or only those with pus, or only those with polyps, or only those with severe nasal symptoms calling for treatment in themselves? Can we do anything for asthma in working on the nose?

DR. SAMUEL F. KELLEY: In answer to Dr. Kernan's question as to the relief obtained from asthmatic attacks resulting from sinus surgery on those cases who had no clinical evidence of allergic reaction of the nasal membranes as compared with those who had marked allergic reaction, it is desired to state that further study is necessary before reaching any conclusion. Our experience thus far, however, would seem to indicate that more favorable results may be expected in those individuals without evidence of allergic nasal membranes. Whether minor nasal and sinus surgery or more radical surgical procedures were employed depended upon the individual and the extent of pathology present in each case. Relief from asthmatic attacks was observed from antral lavages, removal of polyps and intranasal antral windows, but the improvement seemed to be of a shorter duration than in those cases on whom more complete surgery had been done. Rather complete sinus surgery seems to promise more relief.

Recurrent Lipomamyxochondromafibroma of the Larynx. Dr. Arthur Palmer and Dr. Leopold Mehler.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. LEONID CHERNEY: The paper just presented by Dr. Palmer exhibits several features of great pathological interest. The outstanding feature of the tumor is not its individual constituent parts. There is nothing thrilling about a lipoma or a chondroma or a fibroma; however, the close and intimate association of the three tumors and their location certainly make it worthy of note. As Dr. Palmer has said, there is only one case reported in the literature where a lipoma was associated with another tumor. I have tried to look up the literature myself and have found that the mixed tumor of the larynx and trachea is not a very rare occurrence, but, of course, this tumor does not present the characteristic findings of a mixed tumor.

I will show you the characteristic sections which will illustrate this tumor. (Lantern slide demonstration.)

The first is a section of the fibrolipoma. It is a perfectly straightforward section and you can see adipose tissue and fibrous tissue. If it had been single and had been found in almost any other part of the body, it would not have attracted any attention. There is no question of malignancy.

The second section came from a tumor which was attached to the lipoma; it is cartilaginous. Microscopically, it looks more like the work of an amateur; the individual cells are well differentiated, and the lacunae are quite well demarcated. This particular section would not be considered suspicious.

The third section came from the same tumor but from a different part. You can readily appreciate the difference between the two sections. This portion is decidedly more cellular. The cells vary in size and shape considerably and you can see that they are markedly hyperchromatic. Mitotic figures can be seen here and there, but, all in all, there is not enough evidence to warrant the diagnosis of fibrosarcoma. It is well to bear in mind that chondromas are not very reliable under the microscope. Many patients have had a presumably benign chondroma diagnosed microscopically, and later on have been found to develop metastases.

The fourth section is from the polypoid mass which projected into the larynx. You can see on one side a mixture of serous and mucous glands which are perfectly well differentiated and look quite normal. You can see fibrous tissue, also quite normal in appearance and not at all suspicious. At one end is stratified columnar epithelium, the same as that found lining the respiratory passages.

The section of the main fibroma was more cellular, and the cells also showed considerable variation in size, shape and staining properties. They showed

numerous mitotic figures, and yet it was not a frank fibrosarcoma. I think we are justified in considering both the chondroma and the fibroma to be made up of embryonal cells, as Dr. Palmer said. It is a tumor coming from a branchial cleft rest. We have no direct evidence to that effect. On the other hand, it can hardly be considered as a matter of chance to find three individual tumors in a row coalescing with each other and not independent of each other; also, in view of the fact that two of the three tumors showed young embryonal tissue, I think we are quite justified in considering this a tumor arising from cell rests of the third branchial cleft.

The Effect of Intranasal Phenol Application in Hay Fever Quantitatively Studied by a New Intranasal Swat Test with Pollen Extracts. Dr. Fernand Vistreich.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. FERNAND VISTREICH: I should practically repeat certain pertinent passages of my paper. In this paper on my personal experiences, I refrained from running away with enthusiasm. I also refrained from drawing hasty conclusions or final conclusions on facts which were not completely understood. I introduced this test to test the sensitivity before and after treatment and the value of it is that it makes it possible for the first time to estimate the results by objective evidence and not by mere clinical observation. I heartily agree that we must be cautious; this treatment should not be used indiscriminately. It should be used by competent rhinologists. It should be used with proper judgment and proper experience, after having had instructions from men who have had the proper experience with it; however, as far as a dark outlook is concerned, I feel that it inspires too much fright in those who are present and have not had any experience with this treatment. I will ask your indulgence for just another minute, to support my statement. I think there is too much fear, and that fear is not entirely justified. I ask you all, if the nose is such a sensitive organ of the human body, why is it exposed to all kinds of environmental conditions? Why did not Nature provide for it more protection? Secondly, why is it exposed to so much argyrol packs? I think we use a great deal of conservative treatment directed toward the nasal mucous membranes, and whereas I do not hesitate to acknowledge the sensitivity of the ciliary epithelium, I think all those conservative treatments themselves could cause more damage than good to the nasal mucous membranes if it were as extremely sensitive as it has been pictured. Recently much acclaim has been given to ionization treatment of the nasal mucous membranes, and it has become an important issue in rhinological circles. If for nothing else, Dr. Warwick must be given credit for the tremendous stimulus which he gave to research in the histology, physiology and pathology of the nasal mucous membrane. There have been scores of articles published in the last two years, in almost all of which you can read very encouraging and very reassuring passages regarding the tolerance of the nasal mucous membrane to seemingly drastic treatment.

In conclusion, I repeat that the utmost caution should be used and this treatment should not be given in a casual way. It should be used only by men who know how to do it.

EDWARD BRADFORD DENCH.

The Oto-Laryngological Section of the New York Academy of Medicine at a regular meeting, held April 15, 1936, in the following statement gives expression to its desire to honor the memory of its esteemed confrère the late Dr. Edward Bradford Dench. He was one of the Section's earlier officers and a member whose valuable and frequnt contributions conspicuously advanced its scientific standing. A confrère in whom ability, capacity, skill, judgment, thoroughness were so combined as to mark him as one of America's foremost otologists. It is the desire of this Section of the New York Academy of Medicine not only to honor his memcry but in the recognition of his sterling qualities to perpetuate his memory by inscribing on its scrolls this citation:

Edward Brandford Dench, great physician, dependable confrère, reliable friend. His was a career most worthy of emulation.

(Signed) Dr. Robert Lewis.

EDWARD BRADFORD DENCH.
1864-1936

In the death of Edward Bradford Dench on Feb. 21, 1936, American otology lost one of it conspicuous leaders. Indeed, it may be said that in view of his many important contributions to the specialty, oral as well as written for over 40 years, he may be regarded as its most conspicuous representative.

Dr. Dench was born at Leedsville, N. Y., Jan. 16, 1864. He was the son of Joseph Bradford Dench and Frances Lester Dench, of Fitchburg, Mass., and a descendant of Gov. Bradford, of the Plymouth colony, and of Capt. Robert Dench, who came to this country from England in 1715. Dr. Dench, after attending the Bridgeport, Conn., high school, graduated from Yale Scientific with the degree of Ph.B., in 1883 and from the College of Physicians and Surgeons, Columbia University, with the degree of Doctor of Medicine in 1885. Following his graduation he entered St. Luke's Hospital as interne, where he remained for two years, from there going to the Hudson Street branch of the New York Hospital, where he remained for a like period of time. In 1889 he became connected with the New York Eye and Ear Infirmary in the capacity of Assistant Surgeon. He soon became Surgeon and continued as such until his retirement in 1929. He founded the Otological Clinic of St Luke's Hospital and in 1914 established the Department of Otology at St. Luke's, where he was consulting and attending otologist until 1929. At the time of his death he was consulting otologist to the New York Eye and Ear Infirmary and to the New York Orthopedic Dispensary and Hospital. Dr. Dench was for many years Professor of Otology in the University and Bellevue Hospital Medical College. He was an enthusiastic and faithful member of the various local, national, and international societies connected with his specialty and always could be depended upon to contribute to their programs in a manner that was both instructive and authoritative. He was one of the founders and was the first president of the American Laryngological, Rhinological and Otological Society in 1896, and in 1931 in recognition of his distinguished achievements was made Honorary President of the Society. He was a founder, and former President of the New York Otological Society, 1904-1905. He became a member of the American Otological Society in 1892 and was its President in 1910. He was honored by election to membership in the Royal Society of Medicine, London, and in the Collegium Oto-Rhino-Laryngologicum Amicitae Sacrum. His face was a familiar one at the meetings of the Section of Otology of the New York Academy of Medicine, of which he was a former Chairman. During the World War he held the rank of Major in the Medical Reserve Corps in the army and was active at Camp Upton during the enlistment period.

He married Marie Antoinette Hunt, of Boston, Oct. 3, 1888, and had a daughter, Mrs. J. Russell Hawks, of Detroit, both of whom survive.

Dr. Dench was the author of a widely known and used book on the Diseases of the Ear, which first appeared in 1895 and which went through five editions, the last in 1919. The number of contributions made on the subject of Otology by Dr. Dench exceeds that of any other one in this country. Not merely were they numerous, but many of them were of outstanding value. He read 20 papers alone before the American Otological Society, of which the first read in 1894 was entitled, "Middle Ear Operations as a Means of Improving the Utility of the Organ of Hearing," and was an exhaustive study of operations inside the drum with the indications for their employment and the technique employed. Two years later, he reported a case of thrombosis of the lateral sinus, following suppurative otitis media, cured by operation. We have not taken occasion to look up the statistics but this must have been one of the earliest cases reported in otologic history, certainly in this country.

In 1899 he reported 17 cases of chronic otorrhea in which he had performed the Stacke operation, 13 of these entirely cured and four improved. This was undoubtedly one of the earliest papers in American literature on the radical

operation. In 1901 he reported a case of otitic brain abscess cured by operation. This was one of the first successful operations for brain abscess reported by an otologist in America. Dr. Dench possessed not merely the diagnostic skill, but also the surgical ability to operate in such case. In a comprehensive paper read in 1902 he called attention to "The Value of Bacteriological Examination of Discharge in Acute Otitis Media As Determining the Necessity of Operative Interference." Unlike many others, he did not hesitate to report his non-successes. In 1905 he reported two cases of brain abscess carefully operated upon but which resulted unsuccessfully and in 1906 a case of cerebral abscess following chronic suppurative otitis media, operation and death. An exhaustive paper on Brain Abscess appeared in 1907. In 1908 Dr. Dench reported a case of acute suppuration of the labyrinth, following acute otitis media, operation, recovery. He studied carefully the Haynes method of draining the cisterna magna for otitic meningitis and in 1913 reported three cases treated by the method without success. A year later he contributed a paper to the proceedings of the Society on "The Treatment of Accidental Wounds of the Dura During Operations Upon the Mastoid Process, with a Report of Several Cases." Dr. Dench was a pioneer in the use of a graft in the radical mastoid operation and in 1915 contributed a paper on that subject. He was an enthusiastic supporter of the investigation of progressive deafness instituted by the American Otological Society and at the time of his death was a member of the special committee having the work in charge. In 1921 in a paper on "Operative Procedures Upon the Internal Jugular Vein in Cases of Sinus Thrombosis of Otitic Origin," he discussed in a masterly way the operation and in 1925 he presented an authoritative paper before the Society on Labyrinthine Surgery.

To the American Laryngological, Rhinological and Otological Society, of which he was the first president, he contributed no less than 25 papers, extending down almost to the year that he was stricken. Of these mention should be made of a paper presented in 1899 on "The Technique of Synchiotomy for Improving the Hearing in Otitis Media Chronica Purulenta with Improvement in 25 Out of 26 Cases." He was one of the first to advocate ligation of the internal jugular in septic thrombosis of the lateral sinus and in 1900 reported three cases where he had successfully tied that vein. This was followed two years later by an excellent paper on the same subject. At the meeting of the Society in 1903 he contributed a paper giving a complete description of the radical mastoid operation and recommending the use of a Thiersch graft. In 1907 he reported three cases of suppurative labyrinthitis cured by operation upon the labyrinth, a further example of his pioneer work. In 1912 he was among the first otologists to report two successful operations on brain abscess. In a paper read three years later he again discussed the value of the labyrinthine operation. We have not, on account of time, included any papers that he read before the International Congresses. His contributions were always timely and in many instances represented views and work well in advance of most of his confrères, as, for instance, his ligation of the jugular vein in lateral sinus thrombosis.

Dr. Dench was a close observer and an indefatigable worker. Some phase of otology was in his mind during all his waking hours. Indeed, to the question he was once asked, "What is your hobby?" he replied, "Otology."

While still active in his specialty, Dr. Dench was stricken in 1929 and was from that time until his death a constant sufferer. Through it all his mind remained clear and he continued to keep in touch with all that concerned the science of otology. The courage and patience displayed by him during his long illness call forth only words of praise and admiration. To him fittingly can be applied the lines of Robert Browning:

> One who never turned his back but marched breast forward,
> Never doubted clouds would break,
> Never dreamed, though right were worsted wrong would triumph,
> Held we fall to rise — are baffled to fight better, sleep to wake.

NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTO-LARYNGOLOGY.

Meeting of May 20, 1936.

ARTHUR BALDWIN DUEL.

The Section in Oto-Laryngology of the New York Academy of Medicine records with deep sorrow the death of Dr. Arthur Baldwin Duel, which occurred at his country home near Pawling, N. Y., on April 11, 1936.

At the time of his death Dr. Duel was Senior Aural Surgeon in the Manhattan Eye, Ear and Throat Hospital, Chairman of the Board of Surgeon-Directors and Vice-President of the hospital. His first appointment in the Manhattan Hospital dates back to 1895 and was in the Throat Department in the Clinic of Dr. Charles Knight. His first work in otology was done in the New York Eye and Ear Infirmary in the clinic of Dr. Edward B. Dench and later as senior in the clinic of Dr. James F. McKernon. In 1902 Dr. Duel left the infirmary to assume a surgeonship in the Ear Department of the Manhattan Hospital. So, from 1895 to 1936, he was in continuous service in the Manhattan Hospital, a period of 41 years — surely an honorable and enviable record.

Honors in the otological world came to Dr. Duel in the course of the years. He was Chairman of the New York Otological Society in 1921-22, and President of the American Otological Society in 1927.

Throughout his career Dr. Duel was pre-eminently a clinician and the contributions he made to otologic literature were those of the keen observer and skillful operator. We find him only a few years ago collaborating with his friend, Sir Charles Ballance, in a long and tedious research concerning the surgical treatment of facial palsy by the use of nerve grafts. This research took place at his country estate and called for the erection of suitable buildings for the care of the animals, as well as complete equipment of an operating room with all that that implies.

The results of this research are known to you. They were first reported at the meeting of the Amrican Otological Society in 1931 when a joint paper was presented, entitled: "The Operative Treatment of Facial Palsy by the Introduction of Nerve Grafts into the Fallopian Canal and by Other Intratemporal Methods."

Other contributions followed and the last of these at home will be fresh in the memory of those who heard Dr. Duel make his presentation before this Section when it was in process of formation by uniting the previous Otological and Laryngological Sections. Dr. Duel had been called upon by foreign societies to explain the Ballance-Duel method. He read a paper before the Collegium at Stockholm two years ago and was invited to demonstrate the operation by the Royal College of Surgeons in London. Last summer he was one of the party visiting in South America. During this cruise he was called upon to talk about the method in several countries.

We are rather close in point of time to be able to get a true perspective of the value of this research. There is no doubt that it is of great value and that this will be more and more appreciated as the years go by and as experience increases. It seems safe to say that the facial palsy work was the crowning point of the professional career of Dr. Arthur B. Duel, and it is to be hoped that hands and heads and hearts will be found to continue the experiment to an ultimately successful issue.

Recognition and honorary award from abroad would undoubtedly have come to both authors and it is sad to recall that both have already passed on.

Arthur Duel was a great personality. Whatever he undertook was done well and in the grand manner, but never with ostentation. Courage was a predominant virtue. He faced all occasions manfully and never more so than when called upon to meet the last and greatest adventure.

He always thought with wide outlook. This quality was well exemplified in his relation to the Research Bureau of the American Otological Society, of which bureau he was Chairman at his death. Begun in a small way as a Committee on Otosclerosis, his was the vision to gather a fund of $500,000, the income of which should be applied in a consistent and persistent search for the causes and cure of progressive deafness. Indeed, his vision extended further — to a much larger fund which would permit the research to become world-wide in extent and to employ the services of those anywhere whose proved work might tend to the solution of this distressing problem. Unavoidable circumstances prevented the realization of these plans but it is good to remember that the Research Bureau, though crippled, still functions and that its annual income will be intelligently applied. Most of the credit belongs to Arthur Duel.

Another characteristic of Arthur Duel was his sincerity. Force of character enabled him to convince others of that sincerity and of the desirability of the project under consideration. With these qualities he proved himself of immense value to those concerned with the building of the Academy in which we now meet, with the Manhattan Eye, Ear and Throat Hospital, with the Research Bureau of the American Otological Society and with his own research on facial palsy.

Added to courage was great determination. Having formed an opinion and mapped a course, the objective was steadily pursued until reached, if reached it could be. And yet withal, there was entire readiness to listen with consideration to the opinions of others.

Arthur Duel was loyal — loyal to his word, to the institutions with which he was connected, and to his friends. In a friendship of 40 years I have never known him to speak a mean word or do a mean act.

He was generous to a degree. Nothing he had was too good for his friends, but all with becoming simplicity and freedom from ostentation.

As a young man Arthur Duel had a very definite and highly commendable ambition. It is surely a tribute to his ability, strength of character and personal dignity that his hopes and aspirations were fully realized.

It would be idle to speculate about the future had he been spared, but it is a consolation to think that this Section can give thanks for a full life and an inspiring example.

Sometimes on occasion an old and maybe threadworn phrase acquires renewed dignity and significance. Those of us who were privileged to know and work side by side with Dr. Arthur B. Duel will always remember him as a "gallant gentleman."

Interlobar Abscess Probed and Drained Through the Cribriform Plate. Cure of Asthma. Dr. J. Ivimey Dowling.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Milk Injection for Pharyngeal and Laryngeal Infections. Dr. Ward C. Denison.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Foreign Bodies in the Pharyngeal Wall with Special Reference to Localization. Dr. Isaac M. Heller.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. RAMSAY SPILLMAN: I had occasion to be interested in this subject through witnessing a case of similar nature at the Manhattan Eye, Ear and

Throat Hospital about two years ago. A surgeon was operating on a patient who was, fortunately or perhaps unfortunately, a personal friend as well, and a round surgical needle broke off in the tonsillar fossa. Attempts were made immediately by the highest ranking men on the staff to locate the needle. The approximate location was known, but the approximate location was not enough. I tried fluoroscopy. I have had some little experience with biplane fluoroscopy in locating small foreign bodies down in the lungs, but I can assure you that in the case of needles in the pharynx, biplane fluoroscopy is quite useless because it is virtually impossible to see the needle and furthermore, the fluoroscopist is in the surgeon's way and vice versa; therefore, after several of the surgeon's colleagues had attempted to help him find the needle, the patient was returned to his bed and he made an uneventful recovery with the needle in situ. We followed that patient at intervals for some time and the needle is still there, without causing any trouble of any kind. Fortunately, no forensic trouble arose either, the patient being a friend of the surgeon.

I should like to show you some lantern slides. The first one is of the case to which I have referred. The slide shows a lateral projection of the neck, not made immediately after operation. It does not show the stage of acute reaction because you see there is no appreciable edema of the posterior pharyngeal wall. In the anteroposterior projection the needle can barely be seen. You can see how difficult it would be to see it fluoroscopically.

I recently discovered a somewhat similar case, quite by accident, in a patient who was referred to me by another man not long ago for a routine sinus examination. I found a needle somewhat similarly placed in the throat. Bear in mind the position of that first needle away back against the spine and notice how far forward this is projected, directly behind the upper molars. In Dr. Heller's case the needle was down behind the angle of the jaw. As far as localization of foreign bodies in it is concerned, the tonsillar fossa is a very extensive region. The next slide is a vertical projection of the same skull. The needle is seen in the left tonsillar fossa. I called the attention of the physician to the presence of the needle. He had not done the operation, but he called up the surgeon who had and the surgeon said that he did not recall any accident having occurred, so that there had apparently been no cause for alarm at the time of operation. It is interesting that in these two cases, which are very much alike, the presence of the needle was known in the one case and not in the other.

I think Dr. Heller's method of localizing these foreign bodies is extremely ingenious and commendable. I am for it. It has occurred to me since that there is a supplementary method that could be adopted in case Dr. Heller's method did not suffice to locate a foreign body. In 1917, Dr. Kenneth Bulkley, of Bellevue Hospital, now in Minneapolis, described in the surgical literature a very simple apparatus embodying an ordinary telephone, such as later came into common use in the earphone radio sets, by which a foreign body in the tissues produced a buzzing in the telephone when the exploring needle was brought into contact with it. Dr. Bulkley reported 33 personal cases of needles, mostly in the tissues of the hand, in which the failure to locate the needle was only 3 per cent as contrasted with 53 per cent in the general experience of a number of other surgeons. I looked up that reference this evening. It is given in the Annals of Surgery, volume 56, 1917. I think it would be worth while to make a note of Dr. Bulkley's work because the use of earphones would facilitate in the search for these foreign bodies and add to what Dr. Heller has already given us.

(To be continued in a succeeding issue.)

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

Meeting of May 18, 1936.

The Schieck Procedure in the Treatment of Iridocyclitis with Presentation of Patient. Dr. H. C. Smith.

In the American Journal of Ophthalmology for April, 1933, there appeared an editorial on a procedure for the treatment of tuberculosis of the anterior segment of the eye called "Local Autohemotherapy." It was brought out that the general condition of patients who were attacked by tuberculous iridocyclitis was usually excellent, and they almost never presented severe changes in the lungs. Their general resistance to tuberculous infection must, therefore, be regarded as good, and special circumstances must have favored invasion of the anterior uveal tract.

Schieck had attributed the peculiar course of tuberculosis of the anterior uvea to the fact that the tissues of this region were bathed by the aqueous humor, which lacked the immunologic qualities of the blood. He had described before the German Ophthalmological Society a method of treatment of tuberculosis of the anterior segment by first evacuating aqueous from the anterior chamber and then at once replacing the aqueous with blood from the patient's veins. He reported 15 cases, out of which 13 were considered cured. He had employed tuberculin at the same time in the treatment of the cases, but attributed only supplemental benefit to it.

The technique was as follows: A needle, carried on an empty syringe, was plunged through the temporal limbus of the cornea until the tip was visible in the anterior chamber. The syringe was withdrawn, leaving the needle, from which the aqueous slowly escaped. A second syringe containing freshly drawn blood was then attached to the needle and enough blood injected to completely cover the iris and the pupil. The number of injections used in Schieck's cases varied from one to four at irregular intervals, depending upon developments. The shortest interval was about two weeks.

The patient presented came to the Eye Clinic at Vanderbilt Hospital June 7, 1935. Her previous history was unimportant except that she had been treated in January, 1935, for acute rheumatic fever. Her present complaint was of redness and pain with diminution of vision in the right eye, the onset being one month previous. Examination revealed all the signs of acute iridocyclitis with many splotchy deposits on the posterior surface of the cornea. A search for septic foci brought a recommendation for tonsillectomy, which was performed. The eye improved and the patient disappeared, but she returned two months later with recurring symptoms. Under local treatment the eye again became quiet; however, the posterior corneal deposits remained, and visual acuity was diminished.

Oct. 11, 1935, the patient returned with the right eye again acutely inflamed and the left similarly affected. The right cornea was now of milky opaqueness and the left was scarcely less involved. The condition had the appearance of interstitial keratitis. None of the usual measures accomplished improvement in either eye and after two weeks it was decided to employ the Schieck procedure.

Oct. 29, the procedure was carried out on the right eye and the patient admitted to the hospital for observation. The next day a great deal of the blood had disappeared from the anterior chamber and the cornea appeared less opaque. After two days the patient was dismissed from the hospital. She had had the usual local treatment and two injections of boiled milk.

Nov. 2, the procedure was carried out on the left eye. This time the patient was not hospitalized. Six days later, the milk opaqueness was much less, wrinkling of the posterior corneal surface being apparent. Vision was definitely improved. The eye has remained quiet except for occasional perilimbal injection. The cornea has shown progressive loss of the posterior opacities and the iris appears normal. Visual acuity at present is 20/40.

Unfortunately, at the time of operation upon the right eye the cornea was too opaque for one to follow the needle in the anterior chamber and the anterior capsule of the lens was opened. Complete opacification of the lens has now developed.

Seven months have elapsed since the Schieck procedure was employed in the treatment of the case and the advantages are unquestionable. Had the left eye been allowed to proceed as the right one was, total loss of vision might have resulted. Tuberculin therapy was not employed in conjunction with the treatment just described.